FEBRUARY 1925.

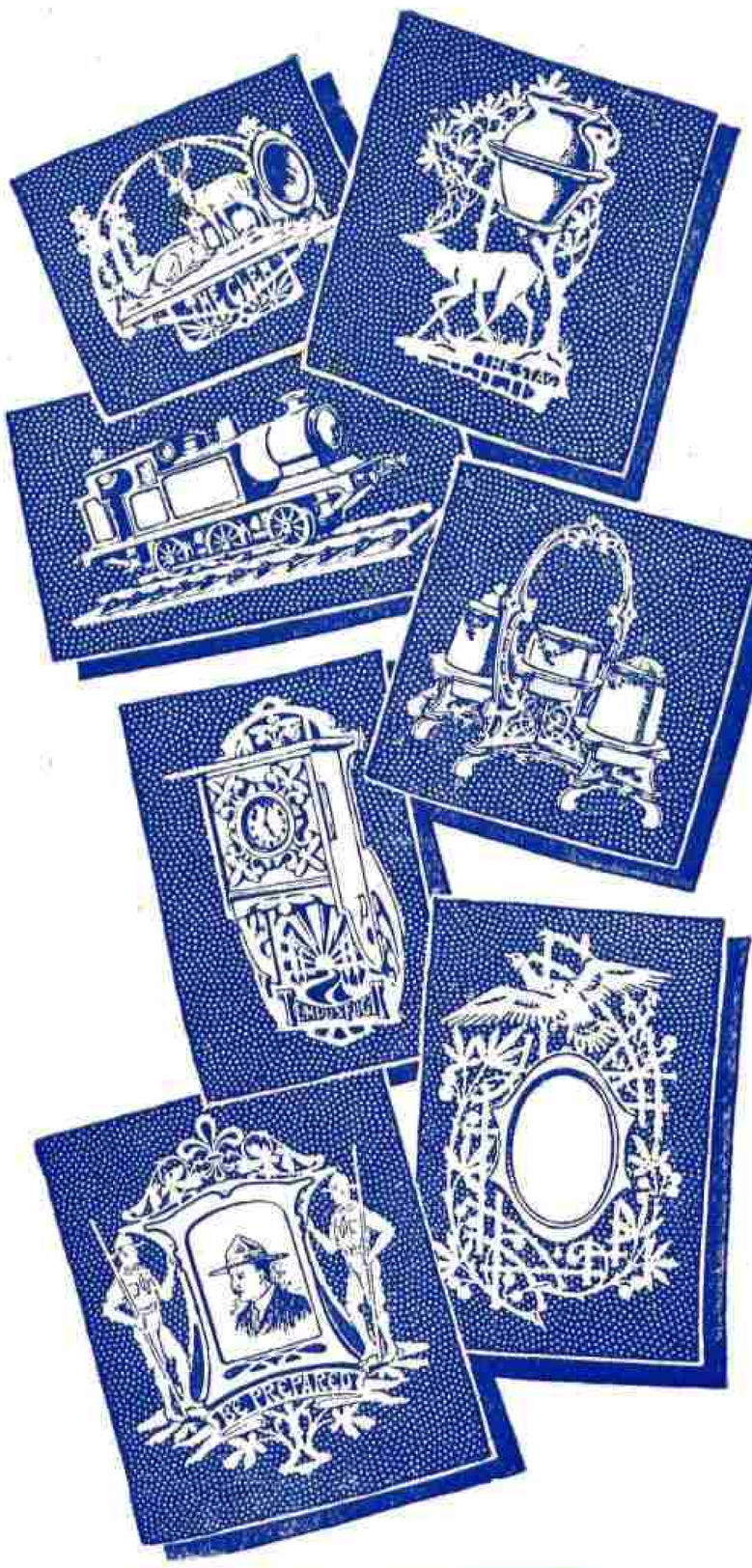
MECCANO MAGAZINE

PRICE 3D

VOL: X
No. 2.



GIANT BLOCK SETTING CRANES. *(see page 54)*



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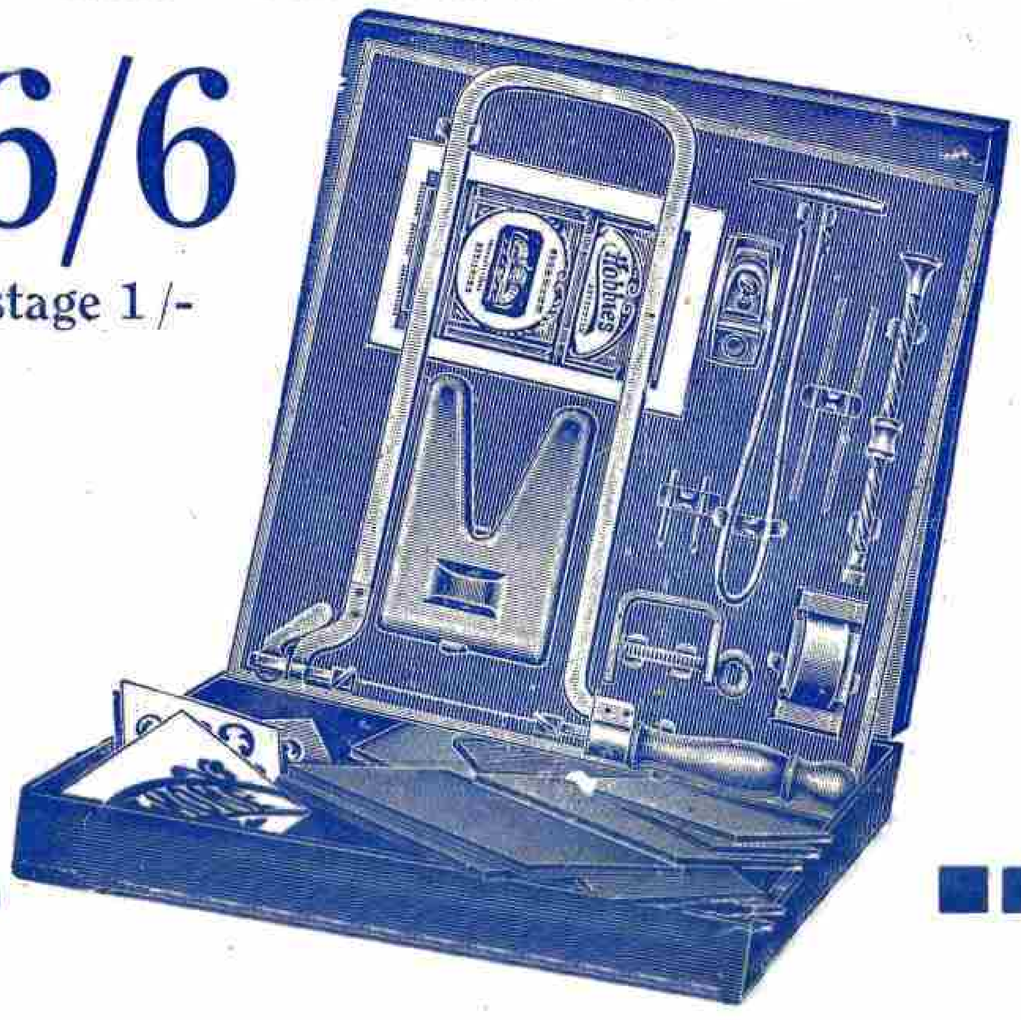
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Vol. X, No. 2.

MECCANO MAGAZINE

PUBLISHED IN THE INTERESTS OF BOYS

February 1925



EDITORIAL

OUR cover this month shows the travelling mechanism of a Giant Block-setting Crane, of the type called "Titan." These cranes are mounted on an under-carriage, which in the case of the crane illustrated consists of two bogies, each with four wheels and running on rails specially laid for the purpose. Titan cranes move along the rails under their own power, which is obtained from the engine mounted on the crane-arm. In the crane illustrated, power is transmitted through shaft and bevel-gearing to the two leading and the two rear pairs of wheels on each side of the track. Our artist has drawn this cover from a photograph kindly supplied by Messrs. Stothert and Pitt, Ltd., Bath, and in the background is seen a "Titan" at work laying blocks at the Madras Harbour breakwater. The work that these huge cranes accomplish is being described in a special serial article, last month's instalment of which dealt with "Goliath" or Gantry cranes. Next month "Titan" cranes will be described and illustrated.

New Features

It has for some time been my desire to introduce regular features dealing with engineering and railway news of the month. I am pleased to say that the permanent increase now made in the number of our literary pages enables me to commence both these features this month. Each month these pages will be devoted to news about the latest developments in engineering, and to news of railway matters, such as Company news, new locos, changes in existing railway stock, and other matters that will appeal to all interested in railways. Should any reader be able to contribute news to either of these pages I shall welcome his contributions, and those that are published will be paid for at our usual rates. The news in these pages will be as up-to-date as possible, but I should like to mention that as the Magazine is printed about a week before publication date, it will not be possible to mention any news received between the date that we close for press and the 1st of the following.

Next Month

In this number we commence the life of another famous engineer, Sir M. I. Brunel, whose life story reads almost like romance. We shall continue this interesting feature in our March issue, describing the construction of the Thames Tunnel, which was perhaps the greatest of Brunel's many achievements, and one rightly regarded as an engineering triumph. We shall continue also our serial, commenced in this issue, on "*The Story of Copper*," our next instalment dealing with copper mining. I am able to announce also for next month, several interesting articles—including a description of a giant electric shovel, that I am sure will appeal to all my readers, bearing in mind the keen interest aroused by our previous articles on steam-navvies. I have in preparation an illustrated article on the largest floating crane in the world, recently built in this country for the Japanese Government. In the March issue, too, I am hoping to commence the story of Dick's Visit to Meccanoland. Since this story was first published in booklet form, there have been insistent demands for it to be printed in the pages of the "*M.M.*" With a view to satisfying these demands, and in the belief that it will be of special interest to our younger readers, I am hoping to commence the story in March. An illustrated article on the famous loco, L.N.E.R. loco 4472, is also being prepared, and also a thrilling description of a notable tragedy that occurred to an intrepid band of Alpine climbers, at the first ascent of the famous mountain, the Matterhorn. In addition to these special articles our regular features will be continued, and, in response to numerous requests, "Rover" will contribute an illustrated article on map-reading.

A Luxury Train

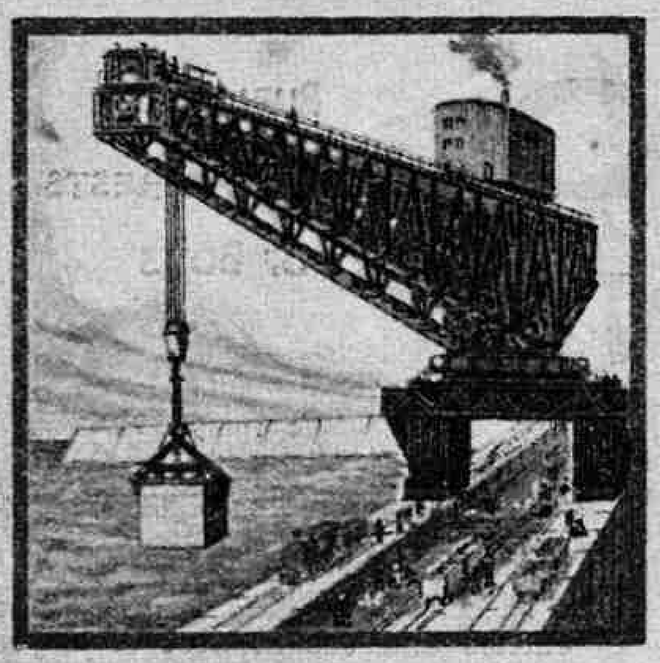
This month I am printing the article on the "Flying Scotsman" that was crowded out of our last issue. The new "Flying Scotsman," which commenced running between King's Cross and Edinburgh on the 1st October last, represents the latest luxury train for express travel. I am told that the coaches alone on the new train cost £35,000. The carriages are fitted with every modern contrivance that makes for the comfort and convenience of passengers. The train is drawn by one of the L.N.E.R. giant engines of the Pacific type, representing an outlay of £7,500. Every week-day at 10 a.m., the Flying Scotsman has left King's Cross for the last 62 years, and I feel sure that my readers will be interested to read the article describing this new train that is taking its place in a notable railway service and doing its best to maintain the record set up by its predecessors.

The New Craze

Our Cross-word Puzzle Contest has been very successful, judging from the number of entries and the interest displayed by the entrants. As everybody is busy with cross-word puzzles these days (not excepting the Editor of the "*M.M.*," to say nothing of his staff!) I think that something I read the other day might be of interest to my readers. A leading American authority states that he believes Adam and Eve probably played at something very similar to cross-word puzzles in the Garden of Eden! Whether this amazing statement is a fact or not, it seems certain that similar puzzles occupied a good deal of the time of the Hindus and the Chinese as far back as 3,000 years ago. The Red Indians, who lived in America before the arrival of the white man, used to play a criss-cross puzzle with grains of corn, each of which was marked with some ancient sign. The Indians probably brought the puzzles to America from Asia, at a time far back in the earth's history when there was no Pacific Ocean and the two continents of Europe and America were connected by land. Cross-word puzzles have been evolved by combining three other kinds of puzzles (the anagram, the acrostic, and the rebus) with the ancient magic squares, which played an important part in the superstition and mysticism of the Middle Ages. Magic squares were known to the Hindus and Chinese before the Christian era, and were introduced into Europe in the 15th century. Cross-word puzzles are closely allied to chess, and possibly they are an earlier form of that game. Incidentally, it is interesting to know that because of cross-word puzzles there has been a dictionary shortage in New York, and the encyclopædias in the public libraries have to be guarded, readers being made to queue up for their turn to look out definitions! The craze is not confined to New York, for a Boston publishing house reports that because of the cross-word puzzle their usual output of 10,000 dictionaries a month has grown to a monthly production of ten times that number. Although they have increased their staff and are working day and night, they find it impossible to keep pace with the demand. So Cross-words have a value to somebody and American business men are very "cute"—I wonder who is responsible for the present craze.
I wonder!

Change of Address

Subscribers should immediately notify the Editor of any change of address. Send a Postcard *giving the old and new address*, **so that records may be kept up-to-date.**



Giant Block-Setting Cranes

Their Work in Constructing Harbours and Breakwaters

(*Continued*)

AS we have already mentioned, no two breakwaters are exactly alike, and almost every harbour requires particular treatment. The form of breakwater decided upon depends firstly, upon the natural conditions of the site, and secondly, upon the amount of money that is to be expended on the works.

Effect of Natural Conditions

When a natural bay is sufficiently sheltered by a projecting headland, it is only necessary to throw a breakwater across the inlet in order to convert it into a harbour. In such a case the entrance would be between the ends of the breakwater and the headland, if the depth of the water here is suitable. Such harbours as these are found at Plymouth and Cherbourg. Sometimes a single breakwater, thrown from a projecting point of a bay and enclosing a partly sheltered area of water, is sufficient protection, as at Holyhead, Alexandria, and Table Bay.

Where no headland or sheltered bay exists in a place where a harbour is required, it becomes necessary to form an entirely artificial harbour, which is, of course, a more extensive project. Such harbours as these are found at Kingston, Madras and, nearer home, at Dover, to which latter work we shall refer again shortly

In addition to such local conditions as land contour, there are several other factors to which consideration must be given when the construction of a harbour is contemplated. Not the least of these is a careful study of the wreck-chart, to ensure that, when constructed, the harbour may be available to the greatest number of vessels in times of distress. Other important factors to be considered are the nature of the anchorage ground to be enclosed, the strength and direction of the currents, the set of the tides, and, last but not least, the proximity of suitable materials for use in the work.

Three Types of Breakwaters

All these matters vary according to the different circumstances of the locality where the harbour is to be built, so that engineers have found it impossible to lay down hard and fast laws, applicable to all cases and all situations. This is why it was stated last month that no two breakwaters are exactly alike. Each harbour requires particular treatment, for where a mound of rubble, deposited in a scattered manner, will serve in one case, such a mound would be quite useless in another.

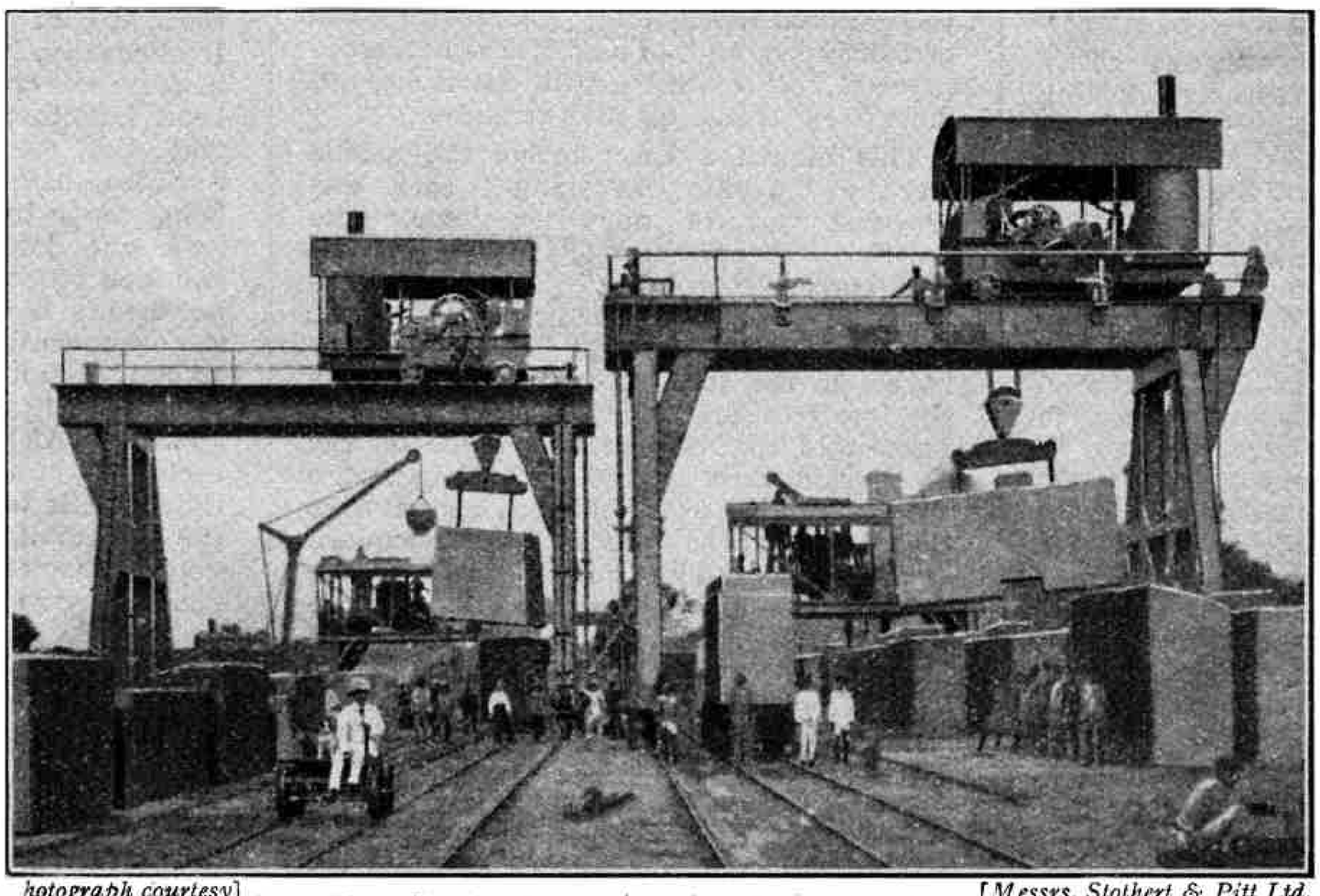
Although breakwaters thus differ in detail in almost every case, they may be broadly divided into three classes. These are (1) the rubble stone or concrete-block mound type, (2) the mound type surmounted by a thick wall, and (3) the vertical wall type, in which a solid wall is carried up, direct from the sea bottom.

Last month we learned something of the necessity for protecting our coasts from the ravages of the sea by building sea-walls, and also of the conversion of natural bays and inlets into safe harbours for shipping, by erecting rubble breakwaters, such as that used at Portland. This month we are to consider cases where rubble breakwaters are incapable of withstanding the action of the waves, and where, as a consequence, more ambitious schemes must be carried out.

(1) Mound Type of Breakwater

Mound breakwaters are generally formed by depositing in the sea a mass of hard material along the line previously chosen for the breakwater. Breakwaters of this type are carried a little above high water level and are placed as squarely as possible to the direction of the heaviest waves, for if placed obliquely the waves would soon scatter the material. Such breakwaters are generally adopted when an abundant supply of suitable material is close at hand. They are only constructed, however, when the space on the sea-floor that the breakwater will occupy is of no consequence, and where no quay is required to be built.

The mound type of breakwater is well represented by the works at Table Bay and Alexandria. The former breakwater runs in a north-easterly direction from a point to the north of Cape Town, and gives shelter from the north-west where Table Bay opens on to the Atlantic Ocean. The breakwater is about 2,400 ft. in length and consists of a mound of rubble stone, which the sea has now levelled on the ocean side to a gradient of about 1 in 9 for some distance below low water. The original work was begun in 1860, and in 1881 an extension of the breakwater was made, bringing the



hotograph courtesy] **Travelling Gantry Cranes moving Concrete Blocks** [*Messrs. Stothert & Pitt Ltd.*

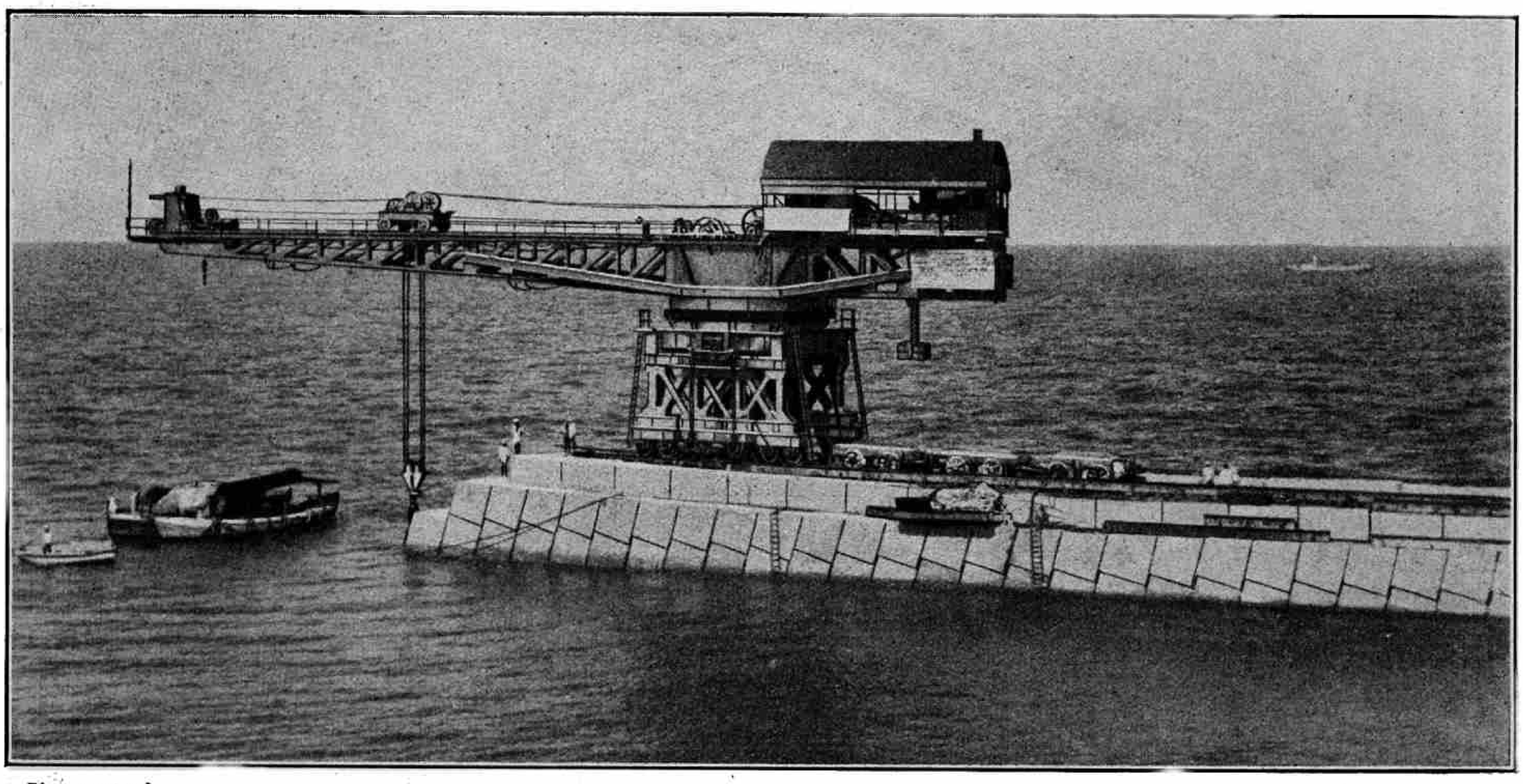


Photo courtesy] [*Messrs. Stothert & Pitt Ltd.*

A Titan Crane Laying Concrete Blocks at Madras Harbour

length of the breakwater to 3,700 ft. The earlier breakwater was in a depth of 30 ft., but the later works extended it into water 50 ft. in depth.

Although this type of breakwater illustrates the simplest possible construction, it requires a large expenditure of material. At Table Bay, however, this material was at hand in the form of stone excavated from a neighbouring site, so that the consideration of transport of the material did not arise.

Alexandria Harbour

Work at Alexandria Harbour was commenced in 1870. The breakwater shelters an extensive bay to the south-west of the town, near Eunostos Point at the south-western end of Pharos. It runs parallel with the shore for 3,500 ft., and then bends inland in a southerly direction. The total length reaches 9,675 ft., the entrance being between the end of the breakwater and the shore. The breakwater encloses a harbour of 1,400 acres, with a minimum depth of 30 ft. and a maximum depth of 60 ft.

The breakwater itself is composed of a mound of large concrete blocks—each 20 tons in weight—on the exposed side, and rubble stone on the shore side. In building the breakwater the concrete blocks were deposited first, the rubble stone being deposited later, under their shelter. The foundation blocks were let down into the water from the deck of a barge, being placed on the inclined plane and allowed to slide slowly into position. It was necessary to exercise greater care, however, in laying the blocks near and above water level. They were brought from the shore by barge and placed in position by a floating steam derrick. Slings clasped each block at its four side edges, and when the block was in position the slings were released by the pull of a rope and the block was left in place. The rubble stone was deposited by barges with trap doors in their floors and sides, in a similar manner to the sack-block system of breakwater construction mentioned last month.

The Alexandria breakwater required only about two years to construct and was completed in 1872. The rate of progress of a mile a year is remarkably rapid, when compared with the construction of such breakwaters as Plymouth and Cherbourg.

(II) Mound and Wall Type

In the second type of breakwater a rubble mound—similar in many respects to the mound described in the first type, is surmounted by a massive wall. This type is well represented by the Colombo breakwater. The advantages of the mound and wall type of breakwater are that it requires less material than the mound type, and also the top of the wall may be used as a quay in fine weather.

Sometimes this type of breakwater is modified and additional protection afforded by laying large concrete blocks at random on the seaward side. This is the case with the breakwater at Boulogne Harbour, commenced in 1879. The mound is carried out about 4,500 ft. from the shore and curves round towards the old jetty, which lies about $1\frac{1}{4}$ miles to the north-east. Two entrances to the harbour are formed between the extremities of two other breakwaters, the remainder of the harbour being protected by a breakwater from the shore close to the old harbour. The mound itself is composed of small stones, covered with larger stones and faced on the outward slope with concrete blocks, each of which weighs 24 tons. The whole is surmounted by a masonry wall, standing about 10 ft. above low water. It is interesting to learn that the material for the mound was at first tipped from wagons run along a track-way, which was laid from the shore on top of the breakwater and advanced to the sea as the work progressed. This method was found to be very slow, however, and barges were subsequently employed.

(III) Solid Wall Type

In the third type of breakwater a massive wall is built of blocks of stone, dove-tailed one into the other in order to present the maximum resistance to the waves. Although this type of breakwater requires less material for its construction than either of the other types, it necessitates more careful construction, and also involves the employment of divers. It is dependent, too, on there being a hard sea-floor at the place where it is to be erected, and also on the water being of not too great a depth.

Of this type of breakwater, by far the most notable example is that of the Admiralty Harbour at Dover. As the construction of these massive breakwaters represents the most modern achievements in this particular branch of engineering we shall deal with it next month at greater length than either of the other types warranted.

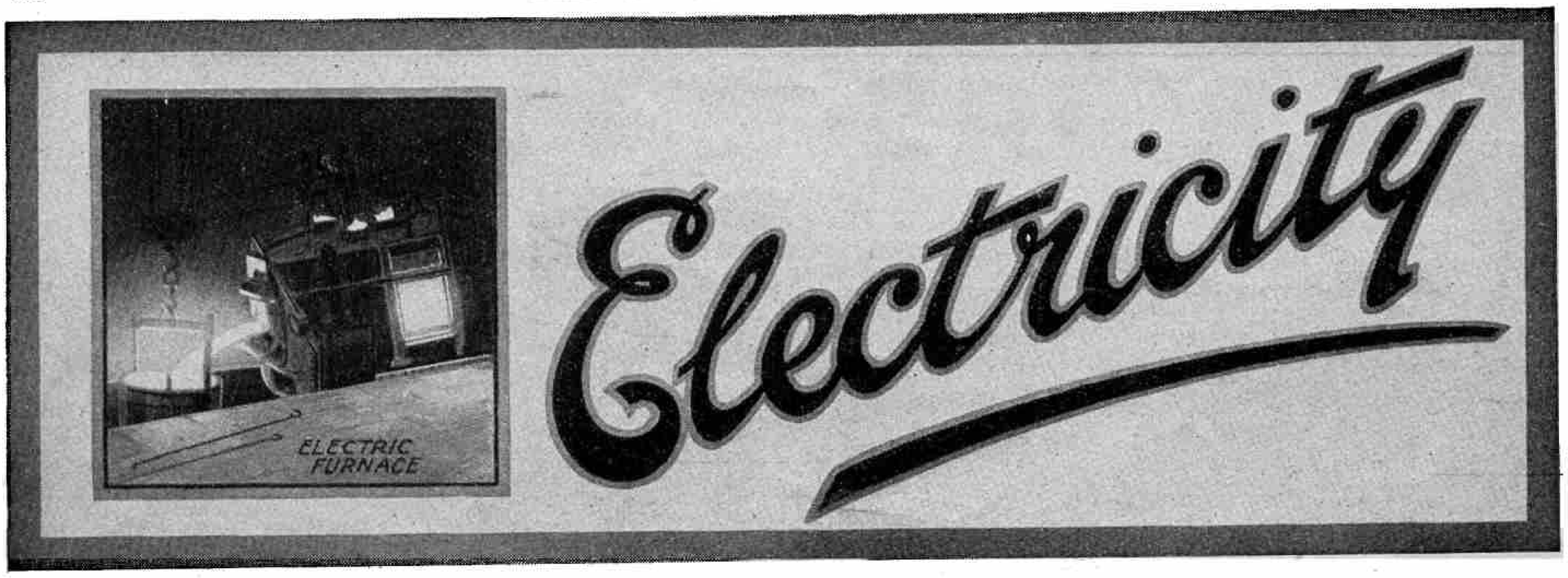
Early Breakwaters at Dover

Because it is situated at the narrowest part of the English Channel and is the nearest point on the English coast to France, the value of Dover as a port has long been recognised. From very early times, indeed, Dover has been a fortified military station, a large part of the castle buildings dating at least from Norman times, if not earlier.

We find that Queen Mary realised that it was necessary to have some form of harbour at Dover, for she sent workmen to Dover to build a breakwater similar to that they had built at Hastings.

The most important improvements to Dover harbour were carried out in the reign of Henry VIII., however, when a small basin was enclosed by a breakwater. This was constructed on the primitive plan by driving two rows of piles into the bed of the sea and filling the space between them with blocks of stone. The waves soon caused breaches in this breakwater,

(*Continued on page* 92)



XII. ELECTRIC CLOCKS

THE great disadvantage of the ordinary pendulum or spring-driven clock is that it requires winding-up periodically to keep it going. It is not a very difficult task to wind up the clocks in our homes, but when the large public clocks in church and other towers require winding, a great deal of energy is called for, owing to the heavy weights or strong springs that are necessary to drive these clocks. It is, of course, possible to instal an electric motor coupled to the winding drum, but this is not always entirely satisfactory.

Clocks that Require no Winding

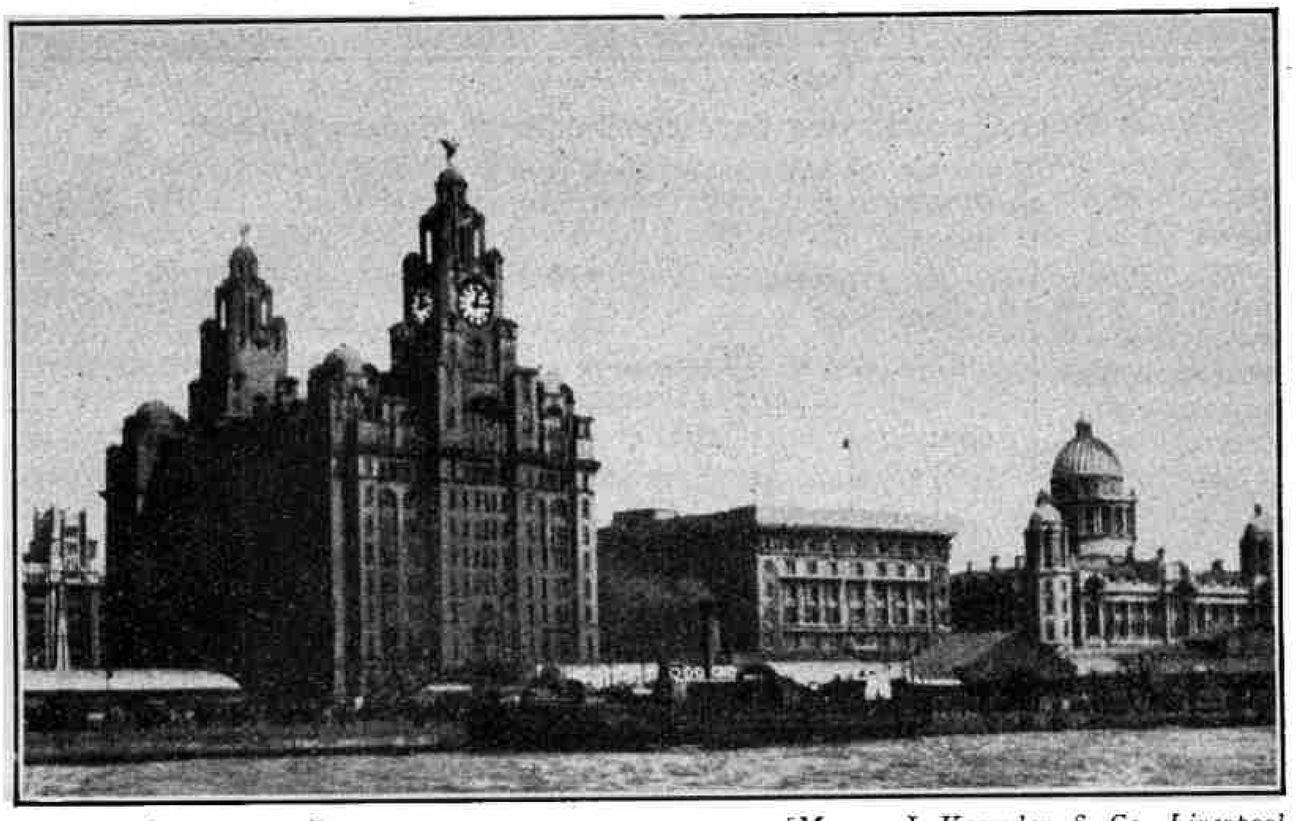
Clocks driven by electricity are free from the disadvantage we have mentioned. Current is directly applied to drive the pendulum, and this, in turn, drives the hands through gear-trains. No springs or weights are required in any part of the driving mechanism.

Once set going, an electric clock will keep on indefinitely, providing that current is continuously supplied. Such a clock requires no attention whatever beyond an occasional check to see that it is keeping correct time. Even this is not of great importance, since many of these clocks may be set so accurately that they do not gain or lose more than one-tenth of a second a week, an accuracy quite sufficient for everyday commercial purposes.

There are three main methods by which a clock may be driven by electricity. In the first and simplest, shown in Fig. 1, the pendulum P, is suspended by the spring S in the usual manner, the bob or pendulum weight B being movable up or down the pendulum in order to regulate the rate of swing. At the extreme end of the pendulum is a soft iron armature A, also shown in the side elevation. Below this there are two electro-magnet bobbins M fixed to the framework of the clock. Thus, as the pendulum swings to and fro, the armature it carries passes over these two magnets and is attracted to them if the current is flowing at the time.

An Automatic Switch

If a switch can be arranged so that the current flows round the magnets when the pendulum is approaching them, and is switched off immediately it is over them, it is obvious that the pendulum will receive a succession of pulls that will be sufficient to maintain its swing.



Photograph courtesy of] [*Messrs. J. Kearnley & Co., Liverpool*

The Royal Liver Building, Showing the Largest Electric Clock in the World

Photo. courtesy] [*Messrs. Gent & Co. Ltd.*

Thirty-nine guests at lunch around one of the dials of "Great George"

This is accomplished by means of the arrangement shown to the right of the pendulum and about half way up. A propelling tongue T is pivoted about half way up the pendulum at the point D, the exact position depending upon the rate and magnitude of the pendulum's swing. This tongue rests in the teeth of the wheel R fixed in the clock framework.

Another tongue T1 rests in the teeth of the same wheel R, and is arranged near a third tongue T2, which rests against the stop S, and which carries the contact screw CS1. The tongue T1 also carries a contact screw CS2, which is adjusted so that it touches the contact screw CS1 when this tongue is raised owing to the wheel R being propelled by the tongue T on the pendulum. The tongues and wheel are arranged so that the two contact screws are touching one another when the pendulum is approaching the magnets from the left. Thus the current from the battery BB flows round the magnets and causes them to attract the armature on the end of the pendulum.

When the armature is exactly opposite the magnets the two contact screws part, the current is switched off, and the pendulum "free-wheels" to the end of its swing. On returning towards the left it receives no pull, but when it is swinging towards the right again it receives another pull from the magnets as before.

Thus the pendulum receives one pull for every complete swing and its swinging is therefore maintained. At the same time the wheel R is being turned by the pendulum, and it is a simple matter to drive the hands of the clock through gears from this wheel.

Some Disadvantages

This is probably the simplest type of electric clock, but it possesses several disadvantages that make it of use only when accurate time-keeping is not essential.

One disadvantage is that it consumes a large amount of electricity. The current is probably passing through the coils of the magnets one-tenth of the time, and as these are usually wound with fairly thick wire, a large amount of current is allowed to flow through them.

Another disadvantage is that the pendulum is never swinging "free," for the tongue T is always rubbing against the wheel R, and has to do considerable work in raising the tongue T1 at the period of swing at which the pendulum is most susceptible to any outside retarding effects—that is, when it is moving slowly at the beginning of its swing.

A third disadvantage is that the strength of the battery BB is not likely to remain constant, and in consequence the power of the pull exerted by the magnets will vary. This in turn will vary the magnitude of the swing of the pendulum and prevent it from keeping perfect time.

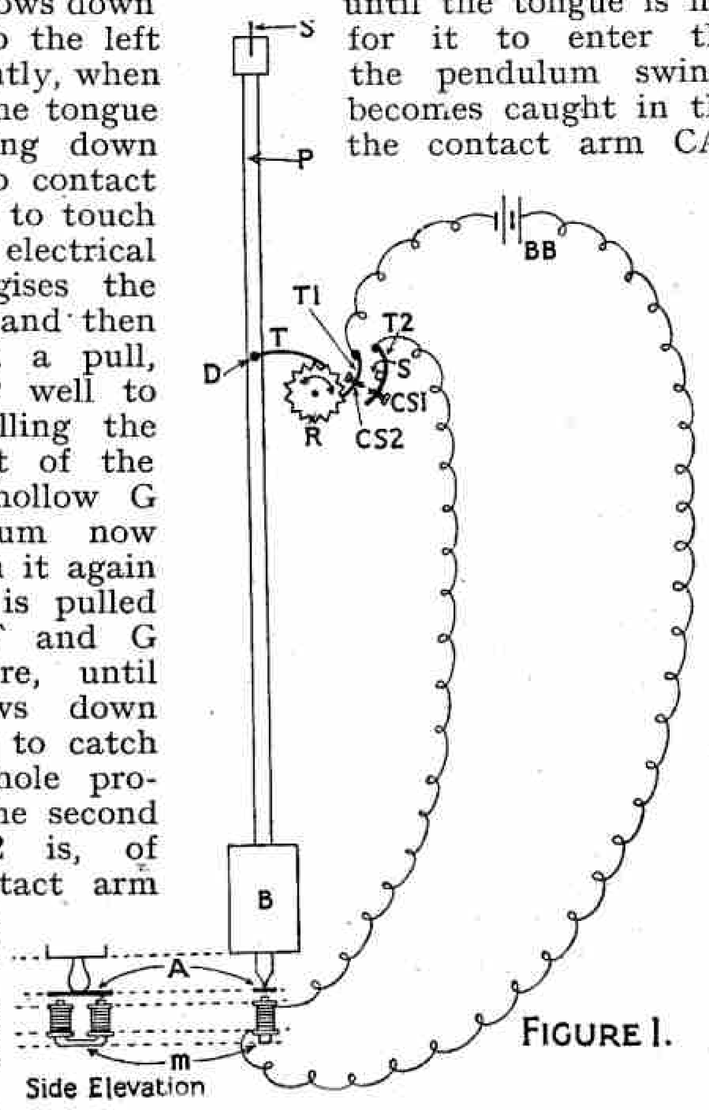
A Second Type of Clock

The second type of electric clock that we shall describe is shown in Figs. 2 and 3. This possesses several advantages over the previous type, the chief being that it requires considerably less current to drive it and that the pendulum is more free. It has one disadvantage of great importance, however, which is that the magnitude of swing varies considerably, much more than in the previous type.

In this clock the pendulum P is suspended by a spring S and has similar arrangements at the foot with respect to the bob B and the armature A, which is attracted by the magnets M as before. The tongue T is pivoted in front of the pendulum at the point D on the pendulum (Figs. 2 and 3). As the pendulum swings to and fro the tongue T is pulled across the catch C (Fig. 3) on the contact arm CA1, which is pivoted at E and maintained normally against the adjustable stop S1 by the counter-weight W1.

When the pendulum is set swinging towards the left, tongue T is pulled beyond the catch C so that it swings freely in the hollow F. Thus when the pendulum swings towards the right the tongue is inclined as shown in Fig. 3, and therefore passes easily over the catch C until it swings in the second hollow G. The pendulum now swings to the left, the tongue is pulled into the hollow F again, and the process is repeated.

Until now the pendulum has received no pull to keep it swinging, and so it gradually slows down until the tongue is not pulled far enough to the left for it to enter the hollow F. Consequently, when the pendulum swings back to the right, the tongue becomes caught in the catch C, thus pushing down the contact arm CA1 and causing the two contact screws CS1 and CS2 to touch and complete the electrical circuit. This energises the magnets M (Fig. 2) and then gives the pendulum a pull, causing it to swing well to the right, thus pulling the tongue (Fig. 3) out of the catch C into the hollow G again. The pendulum now has a large swing on it again and so the tongue is pulled into the hollows F and G alternately as before, until the pendulum slows down again and allows it to catch in C, when the whole process is repeated. The second contact screw CS2 is, of course, on the contact arm CA2 pivoted at H and provided with a counterweight W2, which normally keeps it pressing against the adjustable stop S2.

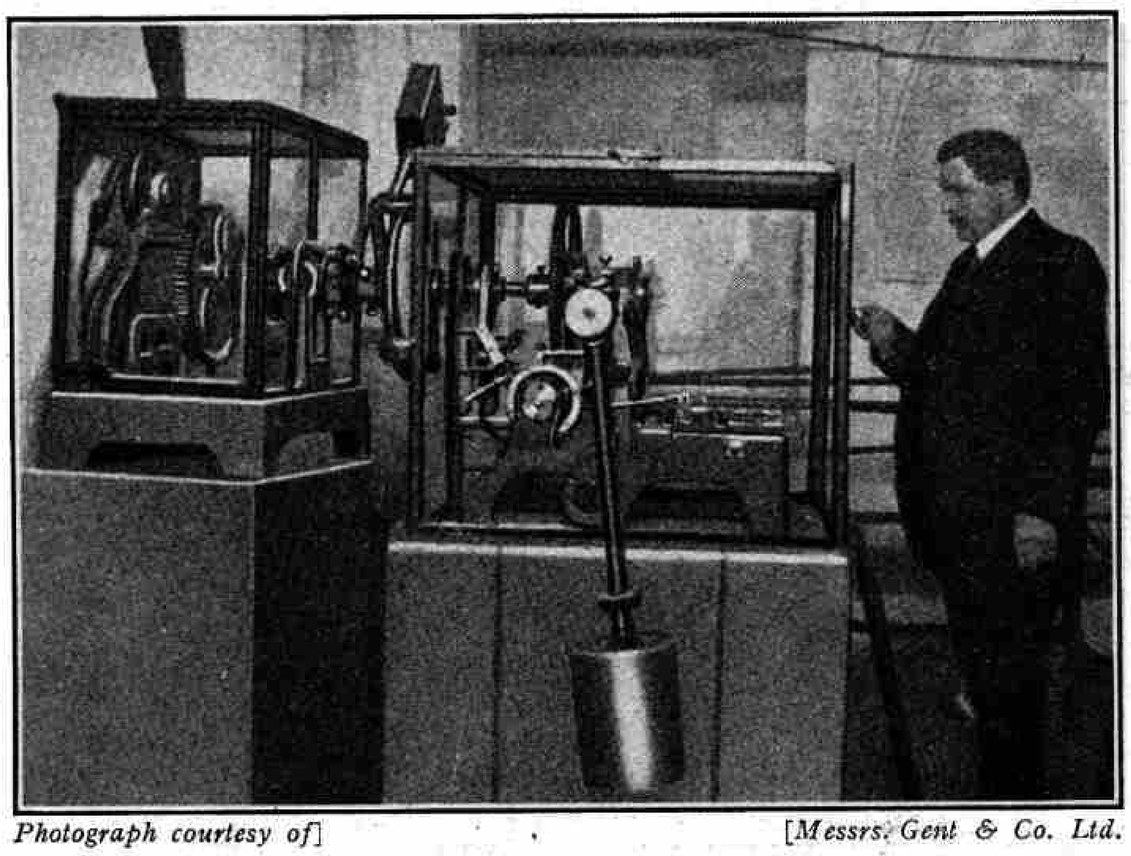


Side Elevation

FIGURE 1.

With this arrangement the pendulum receives a single pull when it requires one. Should the battery become less powerful, the result is that the pulls are required more frequently. In practice the pendulum will swing from five to twenty times with one pull, according to the state of the battery.

The hands of the clock are driven through an escapement wheel, which is similar to that in an ordinary clock



Photograph courtesy of [*Messrs. Gent & Co. Ltd.*

The Control Mechanism for one of the Dials, "Great George," Royal Liver Building, Liverpool.

A Gravity Clock

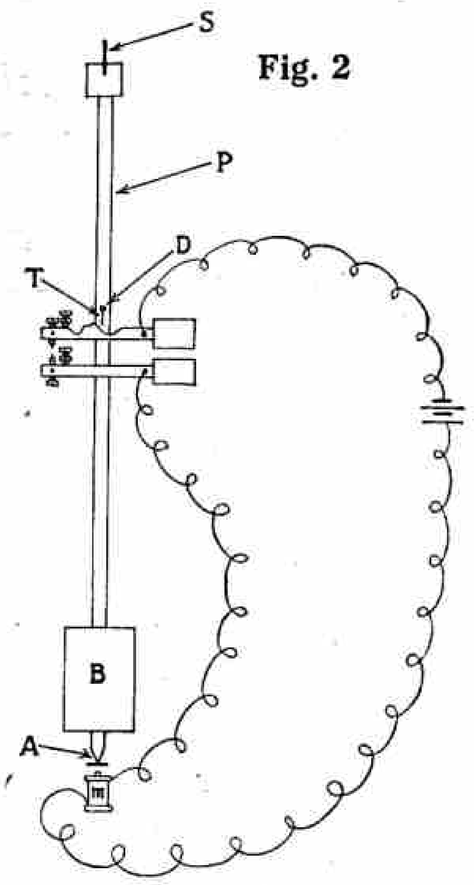
The third type of electric clock embodies the principle used in most electric clocks when great accuracy is required, such as for turret clocks and for master clocks which have to control many other dials. Fig. 4 illustrates the chief points in the design.

As before, the pendulum P is suspended by a spring S and carries a bob B at its end. A certain distance from the spring S the click C is pivoted. From the diagram it will be clear that each time the pendulum swings towards the right the wheel W will be moved round one tooth, the right-hand end N of the click C passing in the loop of the catch-arm CA, which, pivoted at D, holds up the gravity arm G. This arm is pivoted at H and carries the contact screw CS1 and the roller R.

The wheel W consists of 15 teeth, one being cut deeper than the others. Consequently, when the point of the catch C falls into this tooth, the right-hand end N rises higher than usual and does not pass into the loop of the catch arm CA but strikes it at the point J. This causes the catch arm to release the gravity arm G, which, in falling, allows its roller R to give the pendulum a push by striking and rolling down the impulse bracket K fixed to the pendulum.

When the gravity arm reaches the end of its fall, the contact screw CS1 meets the contact screw CS2 on the armature L. This completes the electrical circuit, the magnet M attracts the armature L which pushes up the gravity arm G and returns it to the catch on the catch arm CA, which by now has returned to its normal position.

Fig. 2



Advantages of Gravity Type

The object of this movement, of course, is to give an impulse to the pendulum, and the whole cycle of operations takes no longer than a quarter of a second. The pendulum now continues swinging and the click C turns the wheel W round until it comes to the deep tooth again, when the pendulum receives another impulse.

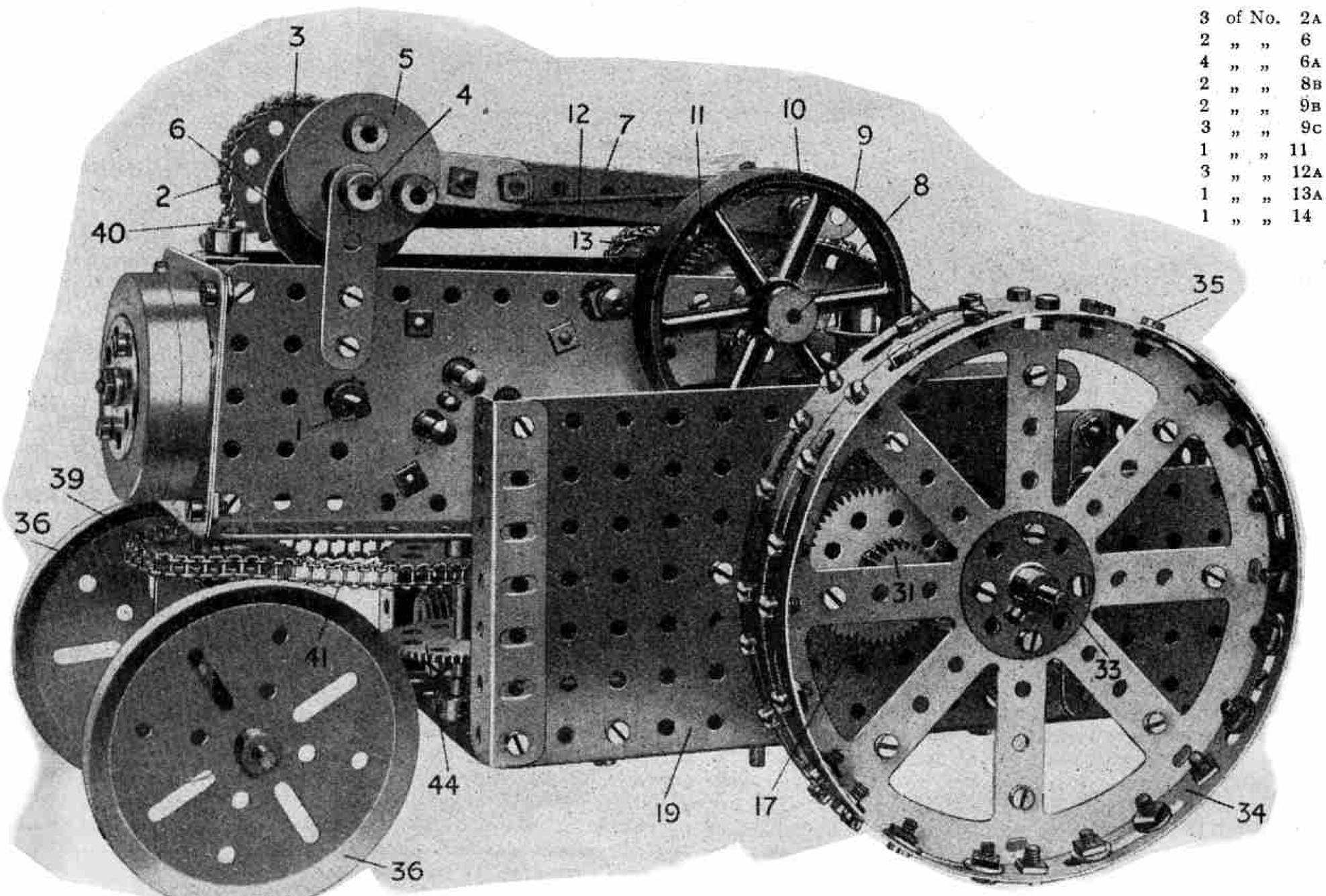
The advantages of this system are as follows. The pendulum is only doing work when travelling at its greatest speed, for it is then that it propels the wheel W or releases the gravity arm G, and it is then also that it receives the impulses from the roller R. This is a feature of great importance, for if the pendulum had any force, whether retarding or accelerating, applied to it when at the end of its swings, it probably would not oscillate at a constant rate. Another advantage is that the bob B can be made very heavy so that the magnitude of the swing remains practically constant. In an example of this type of clock that we have examined the swing is less than 1/32nd of an inch longer after the pendulum has received an impulse than immediately before it.

This type of clock does not usually have a dial on the same framework. It will have been noticed that there is a temporary switching on and off of the electric current at every 15th swing of the

(*Continued on page* 87)

A NEW MECCANO MODEL

Electrically-Driven Traction Engine



Parts required :

3	of No.	2A	
2	„	„ 6	
4	„	„ 6A	
2	„	„ 8B	
2	„	„ 9B	
3	„	„ 9C	
1	„	„ 11	
3	„	„ 12A	
1	„	„ 13A	
1	„	„ 14	
3	of No.	15	
1	„	„ 15A	
3	„	„ 16	
2	„	„ 16B	
1	„	„ 17	
2	„	„ 19B	
2	„	„ 21	
5	„	„ 24	
2	„	„ 25	
6	„	„ 26	
2	„	„ 27	
4	„	„ 27A	
2	„	„ 30	
2	„	„ 31	
1	„	„ 32	
2	„	„ 33	
2	„	„ 33A	
180	„	„ 37	
60	„	„ 38	
1	„	„ 47	
1	„	„ 48	
2	„	„ 48D	
1	„	„ 50	
2	„	„ 53	
20	„	„ 59	
1	„	„ 62	
2	„	„ 63	
4	„	„ 70	
4	„	„ 72	
½	length		94
4	of No.		95A
2	„	„	96A
2	„	„	103H
2	„	„	115
4	„	„	118
2	„	„	130
1	„	„	132
2	„	„	137
1 Electric Motor 4-volt			

TRACTION ENGINES have been familiar features on our roads for many years, and in spite of the invasion by petrol-driven vehicles they continue in evidence.

Primarily, traction engines were intended for hauling heavy loads for long distances on roads, and were designed to travel at a low speed. Instead of the driving wheels being directly driven from the piston rod, as in the case of a locomotive, power is transmitted by a system of spur gearing. The effect of this is to develop a much greater tractive force for each h.p. of the engine.

The driving wheels of a traction engine form the rear pair and are usually of large diameter. The leading pair of wheels are considerably smaller, and their axle is capable of being turned about a central pivot, by which means the engine is steered.

Compound Traction Engines

Small traction engines are generally driven from a single cylinder, but large engines intended for heavy work are of the compound type with two cylinders, high and low-pressure. Traction engines of this type show several advantages over the single cylinder type. For example, with compound cylinders the full expansive force of high-pressure steam is utilised, effecting a saving in fuel and water of from 20 to 30 per cent., with a corresponding saving in the life of the firebox and boiler. This economy in fuel and water consumption is of great importance, apart from the reduced working costs, for often traction engines are required to travel considerable distances, and fuel and water are not always available at all points on their journey.

A further advantage of the compound type is the fact that high-pressure steam can be admitted momentarily into the low-pressure steam-chest by means of a self-closing starting valve, the power of the engine being thus increased and starting facilitated. There is also less risk than with single cylinder engines of sparks being thrown out of the chimney. Yet another advantage is that there is less noise, due to the low pressure of the exhaust steam.

Straw Used as Fuel

Although the standard traction engine is designed for burning coal fuel, almost any kind of fuel may be used, providing a suitable firebox and fire bars are fitted. In large grain growing countries such as Canada and the Argentine, straw is used very successfully as fuel. In this case special boilers and extra large fireboxes are needed, together with a special form of grate, spark-arresting chimneys and straw-feeding apparatus. Wood also may be burned and almost any kind of liquid fuel may be employed.

The value of such engines for heavy haulage work is obvious, but there are also other purposes for which engines of this type may be employed, notably in

agriculture on a large scale. Heavy traction engines are not able to traverse the land to be cultivated so as to haul ploughs or other implements, but they are made to do the work indirectly.

Traction Engines on the Farm

The hauling is done by means of a cable system, which does away with the necessity for the engines passing over the cultivated area. For this purpose, two engines are required, each being fitted with a large winding drum around which passes a cable. The engines are placed one at each side of the field and the plough or other implement is attached to the cable. One engine hauls the plough across the field by winding the cable on to its winding drum, after which the second engine hauls the plough back again by the same means. As the engines remain stationary while pulling the plough they are able to exert their full power on the cable. At the end of each " bout " the first engine moves forward a few yards—while the second engine is pulling the plough across the field—and is ready to pull the plough back again as soon as the second engine has completed its " bout." This operation is continued until the field is completely covered.

All types of ploughs may be used with cable haulage—paring ploughs for light stubble skimming and paring, where land has been previously cultivated ; topsoil ploughs for cereal and root crop cultivation ; subsoil ploughs for deep cultivation for potatoes, sugar-beet, and other root crops ; breaking ploughs for ploughing land not previously cultivated and so on. In addition to ploughs, almost all agricultural implements may be operated in the same manner, including harrows, rollers, cultivators, ditching machines, etc.

The value of the traction engine on a farm is by no means confined to this kind of work, for the same engine will successfully operate any kind of farm machinery, being specially useful for threshing and similar purposes.

Light Steam Tractors

Among the many interesting applications of the traction engine, apart from agriculture, is that of supplying the needs of the travelling showman. Such engines haul his caravans and apparatus from one fair-ground to another, and during the " show " they are an economical and reliable source of power for running roundabouts of all kinds and driving dynamos for supplying electric light to the circus tents, stalls, etc.

For certain purposes the heavy traction engine is unsuitable, and a smaller and lighter tractor is substituted with great success. This is particularly the case where soft ground has to be traversed, on which there would be a possibility of a heavier vehicle sticking fast. These light steam tractors have great hauling power, although not so great as that of the bigger type, and they have the compensating advantage that they are able to travel considerably faster.

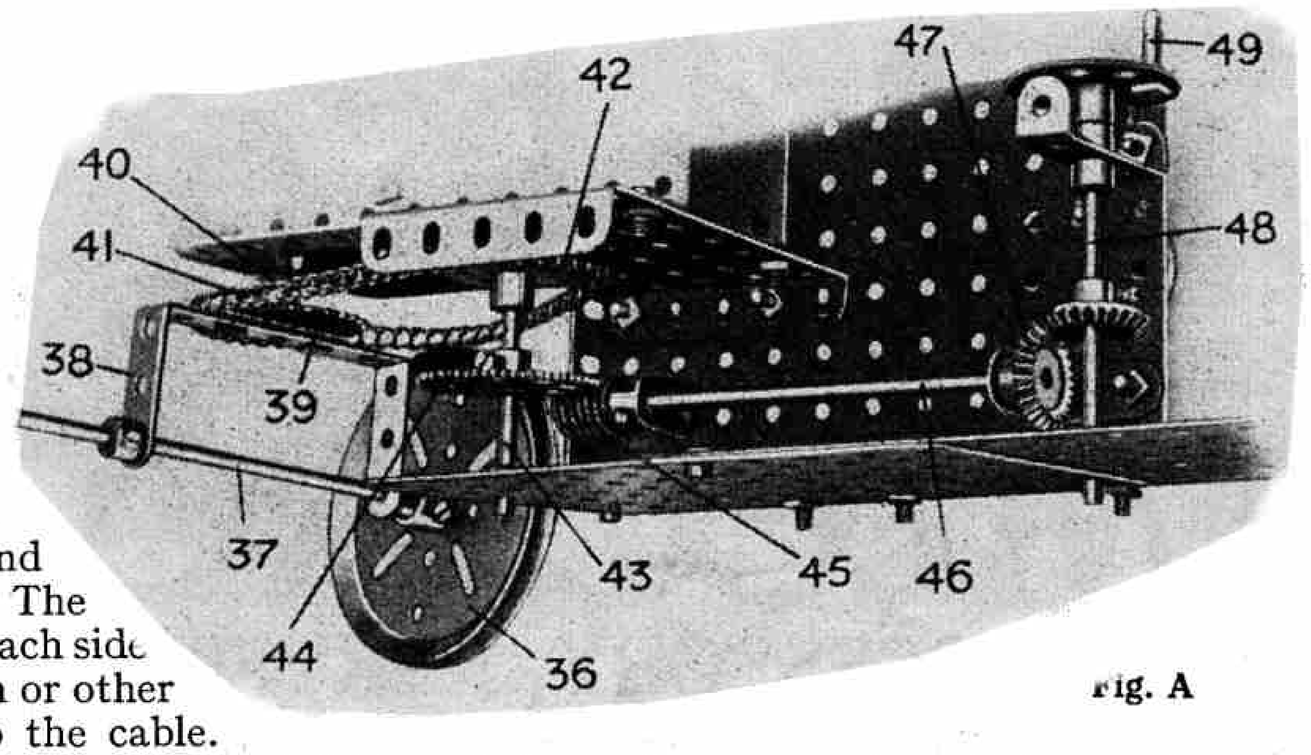


Fig. A

When a tractor is not required for road haulage work it may be used for almost any purpose for which a stationary engine is suitable, including the driving of dynamos, circular saws, pumps and similar machinery. For work of this kind the steam tractor indeed has a very valuable advantage over the stationary engine in that it can go anywhere where work has to be done, and that it can be quickly and easily moved about to the best position for exerting its maximum power.

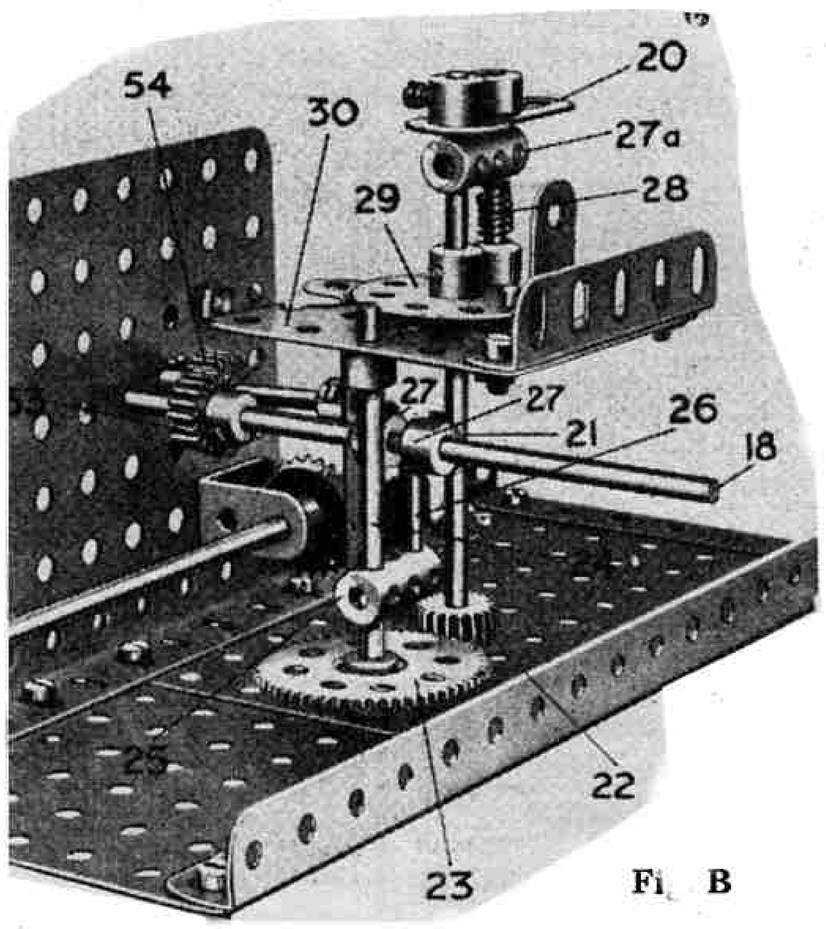


Fig. B

The Meccano Traction Engine

One of the most interesting features of this model is the transmission, which is by eccentrics and pawl and ratchet gearing to the road-wheels. This is a similar form of transmission to that used in the Meccano model of the Constantinesco gear, fitted to the Meccano Chassis and described in our issue of April last.

To deal first with the transmission it may be pointed out that the driven spindle (1) of the Electric Motor carries a $\frac{3}{4}$" Sprocket Wheel, which is coupled by a Chain (2) to a $1\frac{1}{2}$" Sprocket Wheel (3) on the Rod (4).

Secured on this Rod are two Eccentrics (5 and 6) connected by $4\frac{1}{2}$" Strips (7) to Pivot Bolts (10 Fig. C). These are secured to $1\frac{1}{2}$" Flat Girders (10a) pivoting about a Rod (8) carrying the Fly Wheel (9). On the Pivot Bolts (10) are pivoted double Pawls, which engage two 1" Gear Wheels (11) secured on the Rod (8). Spring cord (12) connected to the screws (11b) keep the Pawls in engagement with the Gear Wheels (11).

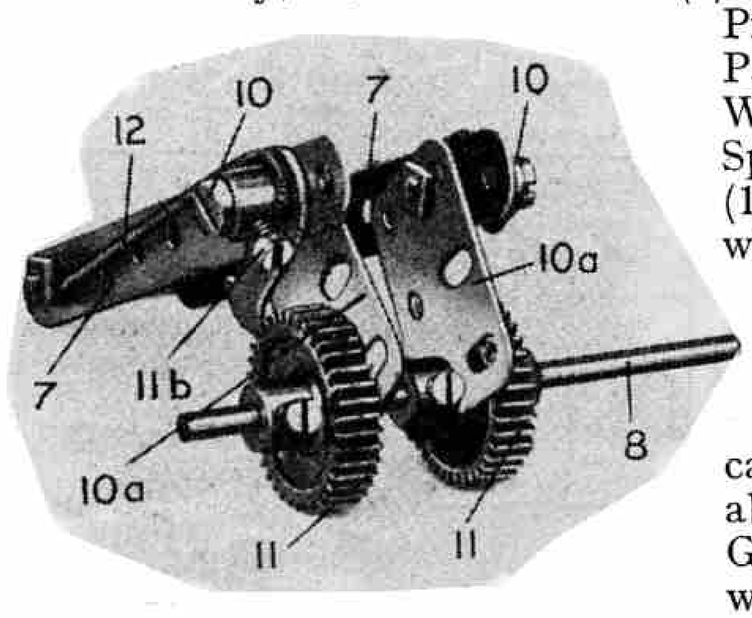


Fig. C

Details of Transmission

Consequently, when the motor is running, the Eccentrics (5 and 6) cause the Pawls to rock to and fro about the Rod (8) and so rotate the Gear Wheels (11) and the Rod (8) to which the wheels are secured. A $\frac{3}{4}$"

(*Continued on page* 61)

MECCANO
ACCESSORY PARTS

WE illustrate a selection of accessory parts that every Meccano boy will find useful in building the larger and more interesting models. Many of these parts have been only recently introduced, and although we know that they have an universal use (were it otherwise they would not have been added to the system) we may not yet know all their applications. There are endless possibilities in the employment of Meccano parts; indeed, we wonder if there is now a mechanical movement known to engineering that any boy cannot duplicate with Meccano.

		s.	d.
10.	Flat Brackets ... ...½ doz.	0	2
11.	Double Brackets ... ... each	0	1
12A.	Angle Brackets, 1" × 1" „	0	1
19A.	Wheels, 3", with set screw „	0	8
20.	Flanged Wheels ... ... „	0	6
	Pulley Wheels :		
19B.	3" dia., with set screw each	0	8
22.	1" „ „ „ „ „	0	4
22A.	1" „ without set screw „	0	2
24.	Bush Wheels ... ... „	0	6
25.	¾" Pinion Wheels ... „	0	6
26.	½" „ „ ... „	0	4
27.	Gear Wheels, 50 teeth... „	0	9
27A.	„ „ 57 „ ... „	0	9
28.	1½" Contrate Wheels ... „	0	9
29.	¾" „ „ ... „	0	6
30.	Bevel Gears ... ... „	0	10
31.	1" Gear Wheels, 38 teeth „	1	0
32.	Worm Wheels ... ... „	0	6
33.	Pawls (complete) ... „	0	4
43.	Springs ... ... „	0	2
44.	Cranked Bent Strips ... „	0	1
45.	Double Bent Strips ... „	0	1
50.	Eye Pieces ... ... „	0	2
57B.	Hooks (loaded) ... ... „	0	5
59.	Collars and Set Screws „	0	2
62.	Cranks ... ... „	0	3
63.	Couplings ... ... „	0	6
63A.	Octagonal Couplings ... „	0	8
63B.	Strip Couplings ... ... each	0	8
63C.	Threaded Couplings ... „	0	6
64.	Threaded Bosses ... „	0	2

		s.	d.
94.	Sprocket Chain per length	0	6
96.	Sprocket Wheels, 1" ... each	0	3
101.	Healds, for Looms ... doz.	0	9
108.	Architraves ... ... each	0	2
109.	Face Plates, 2½" diam. „	0	4
113.	Girder Frames ... ... „	0	2
114.	Hinges... ... ... per pair	0	4
115.	Threaded Pins ... ... each	0	2
116.	Fork Pieces ... ... „	0	3
118.	Hub Discs (5½" diam.) „	1	3
119.	Channel Segments (8 to circle, 11½" diam.) „	0	4
120.	Buffers ... ... „	0	2
120A.	Spring Buffers ... per pair	0	8
123.	Cone Pulleys ... ... each	1	3
124.	Revsd. Angle Brackets, 1" ... ... ½ doz.	0	10
125.	Revsd. Angle Brackets, ½" ... ... „	0	6
126.	Trunnions ... ... each	0	3
126A.	Flat Trunnions ... ... „	0	2
127.	Simple Bell Cranks ... „	0	3
128.	Boss Bell Cranks ... „	0	4
129.	Rack Segments, 3" diam. „	0	6
130.	Triple Throw Eccentrics „	1	3
131.	Dredger Buckets ... „	0	2
132.	Flywheels, 2¾" diam.... „	2	3
133.	Corner Brackets... ... „	0	3
136.	Handrail Supports ... „	0	3
137.	Wheel Flanges ... ... „	0	4
138.	Ship's Funnels ... ... „	0	4
139.	Flanged Brackets, Right „	0	2
139A.	„ „ Left „	0	2
140.	Universal Couplings ... „	0	9
144.	Dog Clutch ... ... „	0	6

You may obtain Meccano Parts from your Dealer

The Meccano Traction Engine—

(*continued from page* 59)

Sprocket Wheel (13) on the end of the Rod (8) is coupled by a chain to a 1½" Sprocket Wheel (14 Fig. D) on a Rod (15). This Rod carries at its other end a ½" Pinion (16) engaging a 57-toothed Gear Wheel (17) on a Rod (18), which is mounted to slide in the Rectangular Plates (19) forming the sides of the Tractor.

The Rod (18) is caused to slide by turning the Crank (20 Figs. B and D), which in turn is secured on a Rod (21) carrying a ½" Pinion (22) engaging a 57-toothed Gear Wheel (23) on another Rod (24). This latter Rod carries a Coupling (25) in which is secured a short Rod (26) engaging between two Collars (27) on the Rod (18).

Below the Crank (20) is fixed a Coupling (27a). A spring-controlled short Rod (28) slides in the Crank (20) and Coupling (27a) so that this Rod (28) may be lifted against the Spring. The action causes its lower end to engage with one or other of the holes in a Bush Wheel (29), secured to the Rectangular Plate (30).

On the Rod (18) is a ½" Pinion (53), and when the Rod slides, this is adapted to engage an idle ½" Pinion (54). This Pinion (54) is mounted on a short rod and permanently in engagement with another Pinion (55) on the Rod (33), upon which are fixed the Travelling Wheels (34).

Reversing Gear

The Rod (33) also carries two 50-toothed Gear Wheels (32). Pinions (31) on the Rod (18) are adapted to be engaged with these 50-toothed Gear Wheels when the Pinion (53) is out of engagement with the Pinion (54), and vice versa. In this manner the Pinions (53, 54 and 55) form a reversing gear, and by moving the Rod (18) by the Crank Handle (20) a forward or reverse drive of the tractor may be obtained. After being moved, the rod (18) is locked in position by the Short Rod (28) engaging one of the holes in the Bush Wheel (29).

The small compression-spring extracted from the Meccano Spring Buffer (part No. 120a) will serve admirably in exerting the necessary pressure on the Rod (28).

Each of the road-wheels (34) is made up of two hub discs bolted back to back, a number of Bolts

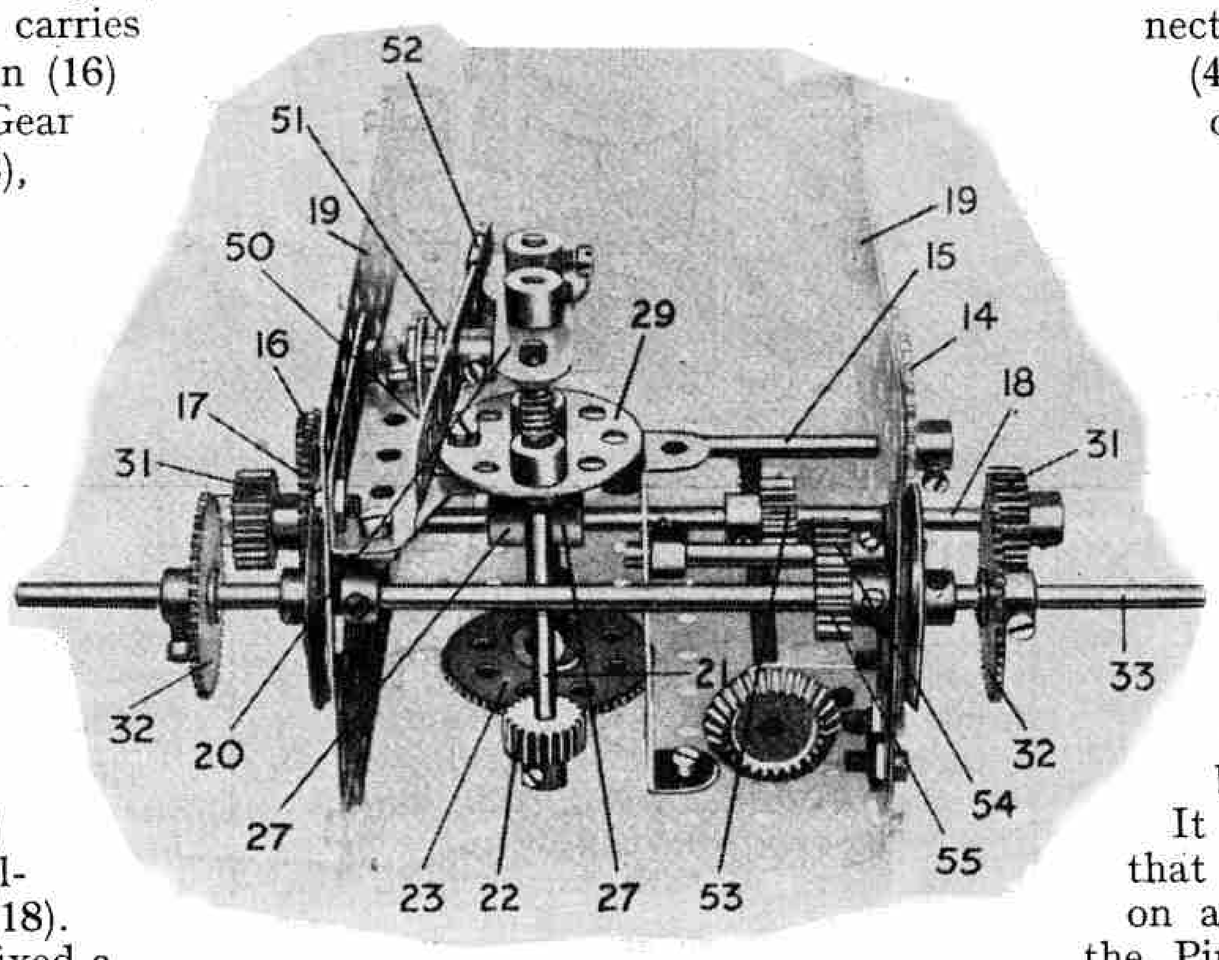


Fig. D

(35) being secured round the flanges to enable the wheels to obtain a grip on the ground.

Steering Mechanism

Fig. A shows details of the steering mechanism. The Steering Wheels (36) are carried on the Rod (37) journalled in a 3" × 1½" Double Angle Strip (38), which is bolted to a 1½" Sprocket Wheel (39) secured on a Rod (40).

The Sprocket Wheel (39) is coupled by Sprocket Chain (41) to another 1½" Sprocket Wheel (42) secured on a Rod (43). On this Rod is a 57-toothed Gear Wheel (44) engaged by a Worm (45) secured on a Rod (46). This is connected by the Bevel Wheels (47) to a vertical Rod (48), on which is secured the Steering Handle (49).

Consequently, by turning the Handle (49) the Worm (45) rotates the Gear Wheel (44) and its Rod (43), the Chain (41) moving the Steering Wheels (36) as required.

The switching of the motor on or off is controlled by the Strip (50 Fig. D) pivoted at (51) and connected to the control lever of the motor by an Eye Piece (52).

It will therefore be seen that if the motor is switched on and the clutch (formed by the Pinions 31) be placed in gear, the drive from the motor to the wheels (34) will be effected through the Eccentrics (5 and 6), Gear Wheels (11) and Gear Train (16, 17, 31 and 32) to the Rod (33) carrying the Wheels (34). While the motor is still running the drive may be declutched by operating the Crank Handle (20).

It should be noted that the Eccentrics (5 and 6) are opposed to one another when secured to the Rod (4). In this way they alternately impart the thrust, or driving motion, to the Rod (8).



BRIGHT IDEAS

These columns are reserved for dealing with suggestions sent in by Meccano users for new parts, new models, and new ways of making Meccano model-building attractive. We are always pleased to hear from any Meccano boy who has an idea which he considers will be useful in the Meccano system.

F. Morris (Upton).—We are afraid that the present design of clockwork motor is not adaptable to a speed regulation. Its power is limited, and any check put upon the spring would decrease the efficiency of the motor.

F. Rimmer (Sydney, N.S.W.)—No 7 Outfit builds all the models in the complete Manual and many hundreds of others. Save up your pocket-money, Frank: and by means of accessory Outfits you should soon be able to build up your present No. 4 into a No. 7, and thus realise your ambition!

Edward Cooper (Acton, W.)—By giving the cord two laps round the crank handle and then fastening with two ordinary half hitches a firm grip is obtained.

E. W. Byles (Dovercourt, Essex).—We have a number of further additions to the Hornby train in contemplation. We appreciate the need of a large type bogie passenger carriage.

J. Schofield (London).—As an alternative to using a strip as a connecting rod you could employ a rod with a coupling at either end, connection being made horizontally through the end hole in the coupling by means of a ¾" bolt. One or two spacing washers on the bolt would ensure free action. This is an instance in which existing Meccano parts are adaptable where they obviate the introduction of special parts.

A. Dakin (Bradford).—A suitable means of connection between Strip and Rod is exercising our attention. Thanks for your suggestion in this direction.

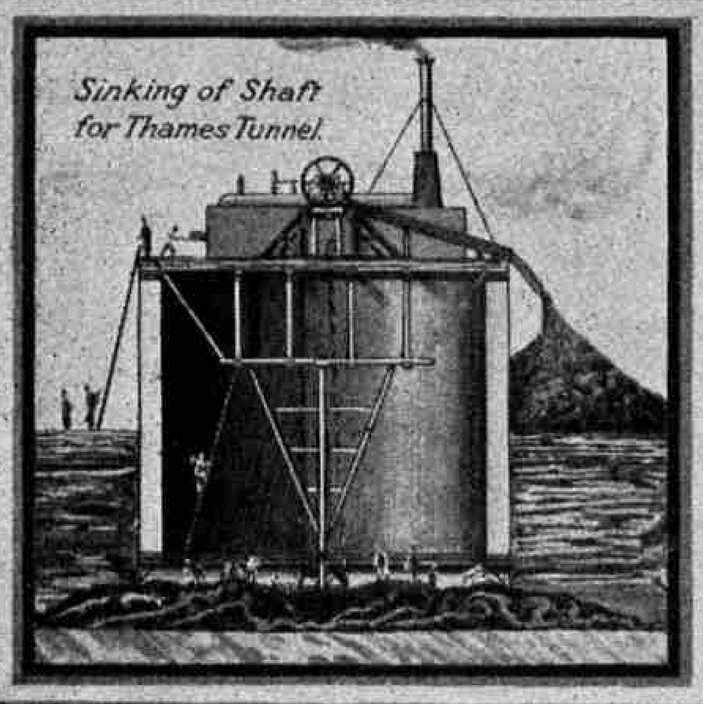
S. Olszewski (London).—Additions to the Hornby Trains are continually being made. Your suggestions for new items have been duly noted.

Ralph J. B. Marsden (Tarver, Lancs.)—(1) We think that a hinge with two hole ends might be a little on the large side. We shall go into the matter. (2) We doubt whether a motor train set would be popular. There are at present no indication of any demand for this particular type of rolling stock.

E. T. Ratcliffe (Faversham).—We fear that the space in our locos is rather too confined for the fitting of a speed controller, although possibly something on the lines of a gramophone controller might be feasible on the larger type. We appreciate very much your keen interest in Meccano, and are always glad to hear from our enthusiastic friends.

Evan Davies (Llanrhystyd).—Your suggested reversed crank can be effected by existing parts, i.e., by employing two ordinary Cranks fastened together. Unnecessary duplication of parts is a thing we try to avoid.

L. Chilvers (Norwich).—Our present Corner Bracket will take care of the functions of your suggested ½" flat angle strip. The latter is certainly neater, but it would duplicate the other. (2) Although we have not shortened the Crank piece we have made a uniform width of ½" over all. We scarcely think that any improvement would be gained by shortening it.



Lives of Famous Engineers

XIII
M.I.BRUNEL
LABOUR SAVING
MACHINES

XIII. SIR MARC ISAMBARD BRUNEL

MARC ISAMBARD BRUNEL was born at Hacqueville in Normandy, on 25th April, 1769. His father was a farmer and small landowner, and the family were highly respected in the district. The boy was destined for the Church, and at the age of eight was sent to the College of Gisors. He proved a hopeless pupil, however, his mind being full of the interesting things to be seen in the carpenter's shop and the wheelwright's yard in his native village. No inducement or punishment could persuade him to give his attention to literary or classical studies. His father was determined that the boy should fall in with his wishes, and after various punishments—including solitary confinement—had failed, he sent him to the Seminary of St. Nicaise at Rouen. This change produced no better result, however, for the lad's love for drawing and for making mechanical models could not be suppressed.

In our March to July numbers last year, we gave an account of the careers of the two Stephensons, George and his son Robert, and we showed how Robert inherited to the full his father's engineering ability. This month we are commencing the story of another father and son who reached great distinction in the engineering world—Sir Marc Isambard Brunel and his son Isambard Kingdom Brunel.

It is interesting to note that—as in the case of the Stephensons—the two Brunels not only reached eminence in their separate achievements but also accomplished wonderful results when working together. There is no more remarkable instance of inherited engineering ability than that provided by the life histories of the Stephensons and the Brunels.

In the following article we deal with the first stage of the career of Sir Marc Isambard Brunel, and show how his keen brain was continually seeking to substitute machinery for hand labour in every possible direction. Our subsequent instalments will deal with the construction of the Thames Tunnel, on which father and son worked together, and with the great personal achievements of I. K. Brunel, including the Great Western Railway and that impracticable monster "*The Great Eastern*," a steamship, which—as we shall see—was many years in advance of her time.

Resolves to Visit England

While at Rouen young Brunel spent as much time as possible wandering about the quay, and one incident of this period is worth recalling. One day he noticed two large iron cylinders that had just been landed, and he was at once eager to know for what purpose they were intended. After making many fruitless enquiries he came across a friendly boatman who told him that the cylinders were part of a steam engine for pumping water, and that they came from England, where many such things were made. "Oh!" the boy immediately exclaimed, "when I am grown up I shall go and see that country!"

Before long it became clear to Brunel's father that his son could not be turned from mechanical pursuits, and he therefore arranged for him to study drawing, perspective, and hydrography, with a view to his entering the navy.

Being interested in his new studies young Brunel made rapid progress, and in due course he became appointed to a corvette. His naval service lasted six years, but of this period of his life there is little or no record and nothing of special note seems to have happened to him.

On leaving the navy early in 1793, Brunel found his country in the throes of the revolution. He stayed for a while with a relative at Rouen, where he met an English lady, Miss Kingdom, who afterwards became his wife. Brunel's position as a somewhat enthusiastic royalist became dangerous, but apart from this, conditions in France at that time were terrible, and as there was absolutely no prospect of his obtaining employment, he decided to try to get to America. After considerable difficulty he succeeded in obtaining a passport.

Leaves France for America

In July, 1793, he sailed from Havre on an American vessel, but scarcely had he begun to congratulate himself upon his good fortune in getting safely away from France than he found, to his horror, that he had left his precious passport behind.

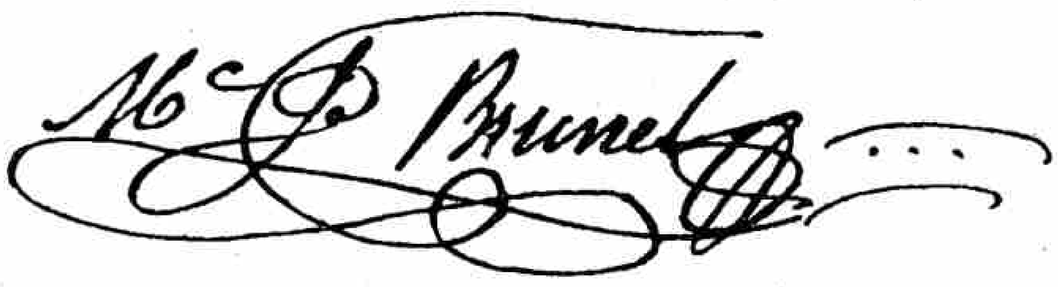
This was a real disaster, but Brunel was not dismayed. Borrowing a passport from a fellow passenger, he produced a copy of it so perfect in every detail, even to the seal, that he felt fairly confident it would escape detection. His handiwork was quickly put to the test, for immediately afterwards a French frigate hove in sight and signalled to the American vessel to stop. Officers came on board to examine all passports, and Brunel, feeling that to draw attention to himself by showing the slightest hesitation might be fatal, was the first to present his passport for examination. His anxiety at that moment may well be imagined, for if any irregularity in the document had been noticed he would have been arrested at once and taken back to France. Fortunately, however, his copy was so well made that it passed muster.

The remainder of the voyage was uneventful, and Brunel landed at New York in September, 1793.

Civil Engineering Career Begins

Brunel was now in a strange land and was faced with the problem of finding employment suited to his abilities. He determined first of all to seek out two Frenchmen, M. Pharoux and M. Desjardins, who had been fellow passengers on the voyage from Havre, and who had come to America on behalf of a French company to organise the survey of a large area of land in the neighbourhood of Lake Ontario. Brunel found his friends and was gladly accepted as a member of the survey expedition.

The three Frenchmen, assisted by four Indians, successfully carried out their task. On the way back to New York, Brunel and Pharoux made the acquaintance of a



Sir Marc Brunel's Signature

Mr. A. Thurman, a prominent New York merchant, who was greatly interested in opening-up the internal communications of the country. Recognising the ability of the two Frenchmen, Thurman engaged them to make a survey for a canal to connect the River Hudson with Lake Champlain. Pharoux was placed in charge of the operations, but he soon came to realise that Brunel's abilities were far superior to his own, and it was not long before he passed over the command to him. This survey marked the beginning of Brunel's career as a Civil Engineer. He carried out other work in conjunction with Thurman, and was so successful that in some twelve months he had built up a considerable reputation and had placed himself on a sound financial footing.

About this time the need was felt in the United States for a larger House of Assembly for the accommodation of Congress, and plans for a new building were invited. Brunel, his friend Pharoux, and many others submitted plans, but the designs of Brunel were so far superior to all others that the task of selection was easy. Although the scheme was abandoned on the ground of economy, the time and thought Brunel had put into these designs were not entirely wasted, for shortly afterwards his plans—considerably modified, however—were accepted for a new theatre in New York.

By this time Brunel had become so highly esteemed in New York that he was appointed Chief Engineer, and in 1796 he was admitted to the full rights of citizenship.

Departure for England

Brunel had never forgotten his determination—expressed years before on the quay at Rouen—to visit England. In 1798 he carried out his resolve, and, setting sail from New York in January, landed at Falmouth in March. Not long afterwards he married Miss Kingdom, the English girl whom he had met in Rouen, six years before. He did not return to America but settled down in this country, where he lived for the remainder of his life.

During the next few years Brunel brought out a number of interesting inventions, including a machine for twisting cotton thread and forming it into balls. His first great work in this country, however, was the invention of machinery for making wooden pulley-blocks for the Navy, thereby superseding the slow and costly method of production by hand.

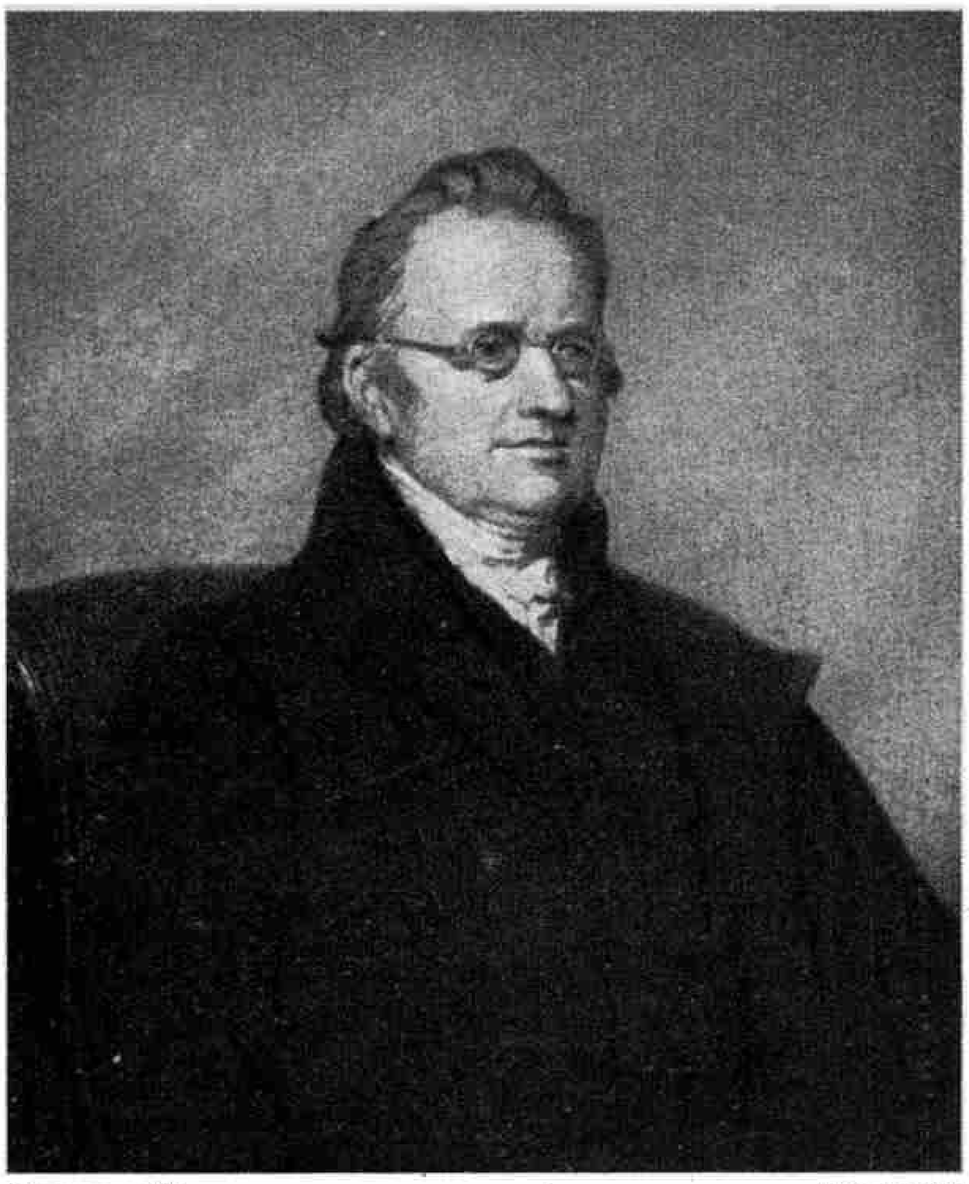
Block-making Machinery

As we saw in our December issue, a block is a case containing one or more pulleys by means of which heavy articles are easily raised or lowered. At the period of which we are writing, ships were entirely dependent on their sails, steam-engines not having then been introduced. All sails were raised or lowered by means of blocks and pulleys, and some idea of the number used in the Navy alone may be gathered from the fact that a 74-gun ship required no less than 1,400 blocks of various sizes.

Although the making of blocks might be thought to be quite a simple process, as a matter of fact it was no means easy. Any hitch in the raising or lowering of the sails of a ship might, in certain circumstances, be followed by serious results, and therefore each part of every block had to be made with the greatest accuracy. Many attempts had been made to produce blocks by machinery, but Brunel's machines were the first to be really satisfactory.

Assisted by Maudsley

Brunel had a remarkably sound knowledge of mechanics, but he was not a practical mechanic, and it was fortunate that he was introduced to Henry Maudsley—the inventor of the slide-rest for lathes—exactly at the correct time. This introduction occurred in an interesting manner. A certain M. de Bacquancourt, another refugee from France, was an accomplished amateur turner, and in passing Maudsley's little shop in London he became interested in the various articles displayed in the window. One day he went into the shop and had a long conversation with Maudsley, with the result that afterwards he was accustomed to call in from time to time to examine whatever new work was in progress. Bacquancourt was also a friend of Brunel, and when the latter mentioned that he was in difficulties in regard to finding a mechanic sufficiently skilled to carry out his designs for block-making machines, Bacquancourt described the beautiful work that Maudsley was producing, and advised Brunel to visit him. Brunel did so and found Maudsley thoroughly equal to carrying out all his ideas with the utmost precision. Ultimately the whole of Brunel's block-making machinery was made by Maudsley, the task occupying nearly six years.



[Engraving from an old] **Sir Marc Isambard Brunel**

Forty-four separate Machines

The remarkable feature of Brunel's block-making process mechanism was that it required no less than 44 separate machines. It would be tedious to describe the process in detail, but in outline it was as follows :—

Pieces of wood were first cut roughly to the size of the block, and were then taken to a *boring machine*. This bored a hole for the pin, and one, two, or three holes—as the case might be—for single, double, or treble blocks, to receive the first stroke of the mortising chisel. Next the block was taken to the *mortising machine*, which cut the mortises for the sheaves. After this the corners of the block were cut off by means of a circular saw, thus preparing the block for the *shaping machine*, which shaped the outward face of the block to its correct curvature. Finally, a *scoring machine* cut a groove to receive the binding or strapping of the block.

The blocks were made of English elm and the sheaves of *lignum vitae*, a wood obtained from a tree grown in the West Indies and in South America, its particular value being the fact that, owing to the diagonal and oblique arrangement of the successive layers of its fibres the wood cannot be split.

In making the sheaves the first step was to cut up the logs of wood by means of a circular saw into plates of the required thickness. These plates were then taken to a *crown saw*, which bored the central hole and also shaped them to a perfect circle. The sheave thus formed then went to a *coaking machine*, the cutter of which, passing around the central hole of the sheave, formed a groove for the insertion of the coak or bush. The sheave was then passed in turn through *drilling, facing, and broaching machines*. Almost all these machines were made in three different sizes to take blocks of various dimensions.

Advantages of Brunel's Invention

The advantages gained by Brunel's block-making machinery were enormous. Not only were the blocks turned out to the desired size with perfect accuracy, thus avoiding all variations due to inferior or careless hand workmanship, but the speed at which they could be constructed was very much more rapid than that of hand labour. Then again, the machine-made blocks were about thirty per cent. cheaper than the hand-made variety.

Mr. Richard Beamish, in his life of Brunel, written in 1862, gives the following striking description of the practical value of Brunel's machinery :—

"Where fifty men were necessary to complete the shells of blocks previous to the erection of Brunel's machinery, four men only are now required, and to prepare the sheaves six men can now do the work which formerly demanded the labours of sixty. So that ten men, by the aid of this machinery, can accomplish with uniformity, celerity and ease, what formerly required the uncertain labour of one hundred and ten.

"Beautiful as are the combinations and contrivances in the block machinery, and highly deserving as the inventor may be of credit for originating such labour-saving machines for the production of ships' blocks, there is a far higher claim to the admiration and gratitude of all constructors of machinery and all workers in metal. In this block machinery exist the types and examples of all modern self-acting tools, without the aid of which the various mechanical appliances of the present day could not be produced with the marvellous accuracy that has been attained."

(*Continued on page* 95)

Stamps for Sale

(*See also page* 66).

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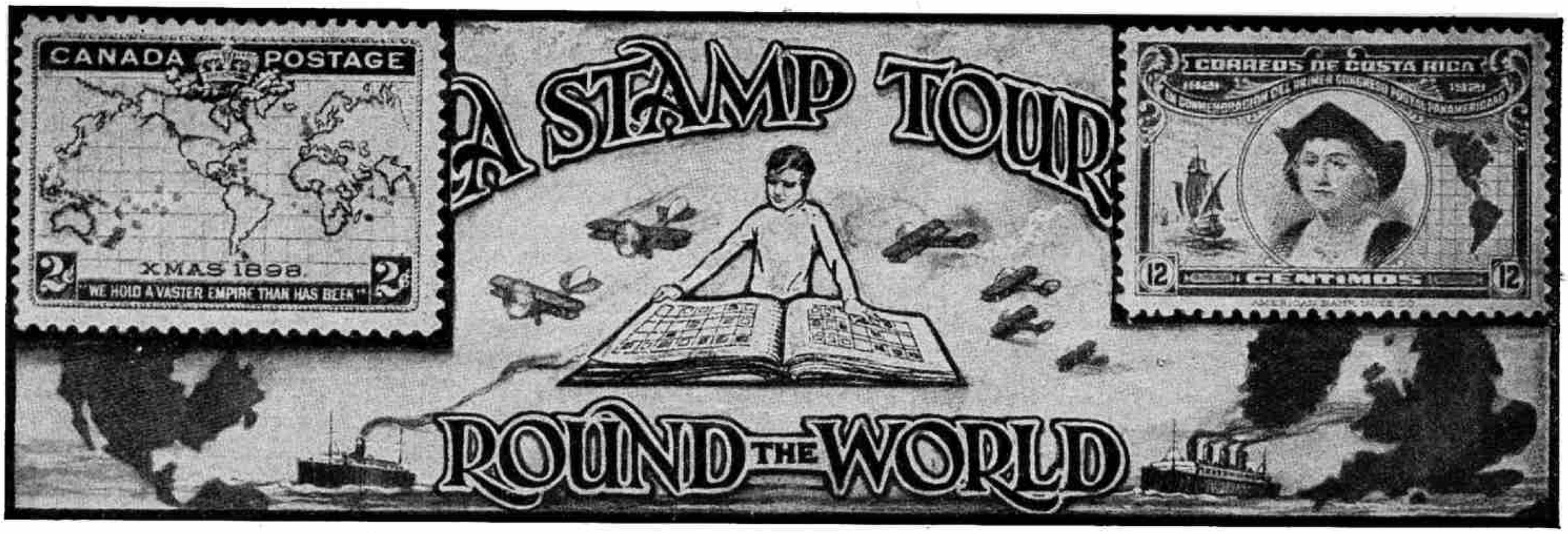
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VI. SOUTH AMERICA

WE have now completed our tour of Central America, and turning our aeroplanes towards the south we regain our ship at Panama. From here we set sail southwards down the Pacific until we arrive at Guayaquil in Ecuador.

From Guayaquil we fly to see Chimborazo (Mountain of Snow), nearly 21,000 ft. in height. This is the highest mountain in Ecuador and was once believed to be the highest in the Andes, but had to give place to Aconcagua, a volcano 23,080 ft. in height, the first ascent of which was made in 1897 by Zurbriggen. Chimborazo is shown on the 1 sucre value of the 1908 commemorative issue and illustrated here. The mountain is snow-clad and believed to be an extinct volcano. Its magnificence is imposing from all points of view, but it is seen at its best from the Pacific side, where the forest rises to the snow-line, above which the mountain towers another 5,000 ft.—a cone of dazzling whiteness.



A Suspension Bridge in Peru

Returning to our liner at Guayaquil we again skirt the west coast of South America until we reach Callao, the seaport of Lima. Although Lima appears on most maps to be on the sea-coast, it is actually 7½ miles inland, standing on the left bank of the River Rimac.

Lima is the capital and principal city of Peru, and many of its buildings and monuments have been portrayed on various postage stamps of the country, notably in the 1907–8 issue. In this issue the 1 centavo value shows the Bolognesi Monument, which stands in a small square of the same name; the 5c. shows the fine equestrian statue of San Martin, the famous South American general. This statue is in the Plaza de la Exposicion. The Medical School is shown on the 20c. value, and the General Post Office on the 50c., the latter building also appearing on the 2 centavos value of the 1897 series, which was issued to commemorate its opening. The 1 sol shows the Hippodrome and the 2 soles the Columbus Monument, which, designed by the famous sculptor Salvatore Revelli, stands in the favourite fashionable walk, the Paseo Colon. This consists of long parallel drives and paths ornamented with many statues set in trees and shrubbery.



Boarding our aeroplanes we fly to Paucartambo, a town important for gold mining. It is situated on the river of the same name, being rather more than three hundred miles east of Lima. Here is a suspension bridge, which is shown on the 1 centavo value of the 1897 commemorative set already mentioned.

One of the Highest Lakes in the World

From Paucartambo we continue inland in order to reach Bolivia, which shares with Paraguay the disadvantage of possessing no coastline. Bolivia is not entirely mountainous, as is usually supposed, over half the country being composed of low-lying plains, swamps and forests.

In this country we first visit Lake Titicaca (1916, 1c.) one of the most highly situated lakes in the world, being 12,644 ft. above sea level. It is 138 miles in length and its greatest breadth is 69 miles. This lake is navigated by steamers running between various ports on its shores and the Peruvian railway port of Puno, a portion of the lake being in Peru.

About 70 miles south-east of the end of Lake Titicaca is the great Mount Illimani (21,200 ft.) with its snow-clad summit. This mountain is shown on the 5 centavos value of the 1916 issue. The 1 centavo of the same issue shows Potosi (15,381 ft.), one of the more prominent peaks in the Cachimayo range.

We now fly still further across the continent until we reach the Atlantic coast and arrive at the capital of Uruguay, San Felipe y Santiago de Montevideo, or, as it is usually abbreviated, Montevideo. This city is the chief port of the country and stands on the north shore of the Rio de la Plata.

Some Magnificent Buildings

Several views of Montevideo appeared on values of the 1895 issue. The 2 centesimos shows the Teatro Solis, or Theatre of the Sun, a magnificent building, as may be seen from the illustration on the stamp. The 3 pesos shows the Cathedral, facing the Plaza de la Constitución. Its two square towers, 133 ft. in height, with the large dome behind, make a very conspicuous landmark for a considerable distance around. The building was consecrated in 1804 and became a cathedral in 1869.

The fortress of Montevideo (1895, 2 pesos) is on an island in the bay and possesses a lighthouse with a light that can be seen 25 miles out at sea.

From Montevideo we fly up the Rio de la Plata until Buenos Aires is reached on the west bank of the estuary. Buenos Aires is, of course, the capital of the Argentine Republic and is 127 miles from Montevideo. The estuary is about 34 miles in width at this point but is so shallow that vessels can only enter the docks through artificial channels maintained by constant dredging.



Several views of this city are shown on the 1910 commemorative issue. The ½ centavo and 10 pesos stamps show monuments erected to commemorate the revolution of 1810, which resulted in the formation of the republic. The 4 centavos shows the historic fortress of Buenos Aires where Don Cisneros, Viceroy of the country before the revolution, was held a formal prisoner until he left for the Canary Islands. The 12 centavos shows the modern Parliament House at Buenos Aires.

Rosario is a river port of Argentina on the river Paraná and is illustrated on the commemorative stamp issued to celebrate the completion of the dock in October 1902. Since that time great progress has been made in extending the port by building quays, drawbridges, sheds, depots, cranes, and other appliances for handling merchandise.



NEXT MONTH:—

THE ISLANDS OF THE PACIFIC

Stamps for Sale

(*See also page* 64)

Foreign Stamps On Approval, all ½d. each, suit beginners.—J. Gleave, Market Hall, Inverness.

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BRITISH COLONIALS ON APPROVAL, one third Gibbons, good copies.—Barlow, 18, Wish Road, Hove.

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250 FOREIGN STAMPS, 5½d., Alexandria, Dahomey, Montserrat, etc. 100 Neurope, 6d. 100 Austria-Hungary, 6d. 50 Colonials, 6d.—White, 98, Bushey Hill Road, Peckham.

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50 STAMPS FREE to applicants for Approvals, all ½d. each. Additional presents for all who buy or sell at least 100 from sheets. Bigger presents for over 100. Enclose postage.—Scott, 154, Wellesley Road, Ilford.

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BRITISH COLONIAL BARGAIN PACKET. Solomon, Turks, Iraq, Palestine, Kedah, Trinidad, Pictorial, Cape, 2½d. Newfoundland, Mosul, Barbados, Cochin, Cayman, Fiji, Soudan, 6d. free. 2 Falkland War Mint included if approval selections requested.—Morris, Stamp Dealer, Bletchley.

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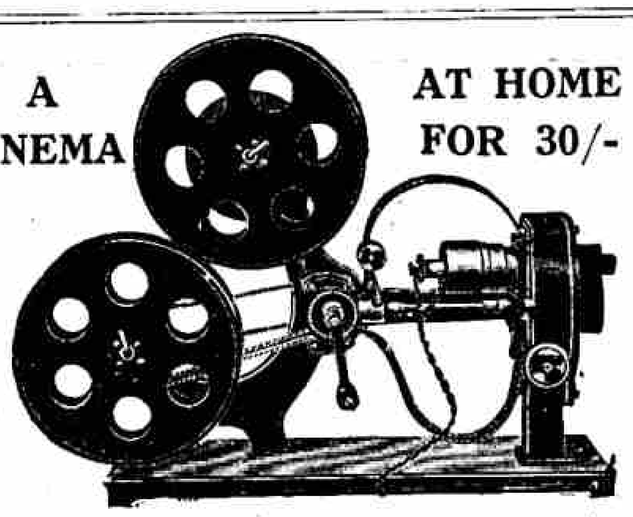
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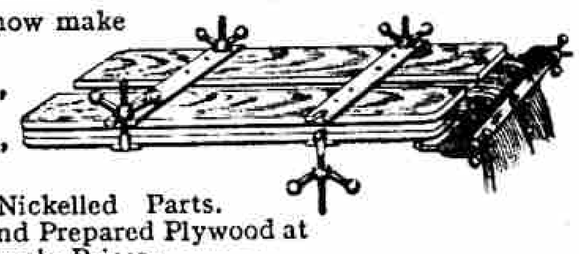
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The Stamps of Togoland

The pre-war German colony of Togo lies between the Gold Coast Colony and Dahomey, West Africa. On 7th August, 1914, the capital, Lome, was captured by the Allies, and Togoland was surrendered by the Germans on 26th August. Until 1921, two sets of stamps were on sale at the same time, the one issued by the British and the other by the French.



The British Expeditionary Force seized some German Togo stamps at Kamina, a town some 100 miles from Lome. These were sent to Lome, and overprinted there at the Catholic Mission. The overprint reads "TOGO Anglo-French Occupation" in three lines, and is found in various sizes on different stamps. Stamps are also known with the whole overprint in capitals, whereas formerly the word "TOGO" alone was in capitals, and there are several other varieties and errors, which are of interest to specialists and advanced collectors.

At first the German values of the stamps were unaltered, but later the stamps were surcharged "Half penny" or "One penny," as the case may be, in addition to the Occupation overprint.



The French overprint is the French translation of the British overprint and reads "TOGO Occupation franco-anglaise." On the German colonial stamps it appears in three lines and is found with either thin or thick letters. Stamps with the thin type were overprinted at Porto Novo, Dahomey, and those with the thick at the Catholic Mission, Lome.

In 1916 the French Colonial stamps used in Dahomey were overprinted with the same wording, but in four lines instead of the three as formerly. The currency of the country was at the same time altered from pfennigs and marks to centimes and francs.

In 1921 the same types of Dahomey stamps—but in new colours—were overprinted with the one word "TOGO," and this is the issue current to-day.

Togoland had an area of over 33,000 square miles. About one third of this is given to Britain and joined to Gold Coast, the remainder is under French protection, which commenced in 1920.

Curious Perforations

Within the last few years various curious perforations have come into use owing to the growing popularity (especially in America) of "penny-in-the-slot" or stamp-vending machines. In this country, up to the present, ordinary perforation has been used for stamps supplied by these machines, but in other countries large holes or rectangles often take the place of perforations to enable the feeders in the machine to obtain a sure hold on the stamps. These varieties are interesting and should be collected, for they show a very important event in the history of the post offices in various parts of the world.

Although it is supposed to be only advanced collectors who distinguish between the different perforations in their collections, the subject is one that is receiving increased attention from collectors in general—principally, perhaps, because some stamps have a very different value according to the particular gauge of their perforations.

RECENT ISSUES

Greece

Lord Byron Commemoratives



It is not often that an Englishman is honoured by a special issue of stamps in a foreign country, but this is the case with Lord Byron, the poet, who died at Missolonghi, Greece, on 19th April, 1824. The recently-issued set consists of two values, both engraved and printed in this country by Messrs. Bradbury, Wilkinson and Co. The 80 lepta, deep blue, shows an excellent and well-known portrait, while the 2 drachma, black and violet, shows Lord Byron entering Missolonghi, the picture being taken from a famous oil painting by Vryzaky. These stamps commemorate the centenary of Byron's death, and have been issued in recognition of his work for Greece in 1824. Both stamps are single-line perforated, and are printed on soft paper without watermark.



Russia, Western Army

Many readers doubtless possess stamps that they are unable to identify, often owing to these stamps not being included in the catalogue they are using. This applies particularly to new Europe issues, many of which are recognised by some firms of stamp dealers and not by others.

A fairly common set of stamps that falls within this category is that issued by the commander of the Western Army of Russia, which claimed independence in 1919. These stamps are catalogued by Messrs. Stanley Gibbons but not by many other firms. The set consists of eight values, 5, 10, 15, 20, 30, 50, 60, and 75 kopecks and is imperforate. All values are of the same design, showing in the centre a double-headed eagle holding a sword in one claw and an orb in the other, in colour on a white ground. Across the top of the stamp are the words РЧССКАЯ ЛОЧТА in two lines in uncoloured letters on a solid ground. At the foot in the centre is the value in uncoloured numerals on a solid ground, and at either side the word КОЛ in thin coloured letters on white.

The eagle is the same as that on the earlier stamps of Russia and very similar to that on the first issue of Bosnia and Herzegovina with which stamps these Russians must not be confused.

We have also seen the same stamps overprinted ЕЛИНСТВО И СВОБОЛА but no information concerning this can be obtained and it must be considered to be an unofficial issue.

Errors of Spelling

People who are able to spell correctly seem to be born, not made. There must be many of our readers who cannot recall ever having had any trouble with the spelling lesson—that bugbear of our school days. After years of struggling to master the spelling of the thousands of words that compose the English language, there comes a day when we no longer have to bother ourselves about it—we find we can spell at last. Some are not so fortunate, however, but seem fated to go through life bad spellers.

Even so, we should not expect to find spelling mistakes on postage stamps but, as it happens, they are comparatively frequent. Such renderings as "censt," "cetns," "cnets," "Pfnny," "Penge," "Peuny," "Pnney," "Pencf," "Dollaps," "Potsage," "Pcstage" and so on are quite common, and even Queensland once spelled her name "Qoeensland!"

Occasionally spelling mistakes have quite a humorous result. In the case of a certain British Colony where a native language is used, a type-setter spelled a certain overprint wrongly. The result was that it read that the reader was a thief, instead of reading that the value of the stamp was altered to one shilling!



New Zealand reveals a glaring example of a spelling mistake in the form of the 2½d. value of the pictorial issue of 1898. The stamp, which is fairly common, was first issued with the name of the lake shown as "WAKITIPU," the correct rendering being "WAKATIPU." This error necessitated a new set of dies being made, and the authorities at the same time took the opportunity of moving the words "POSTAGE AND REVENUE" from the top to the bottom of the stamp and deleted the words "MT. EARNSLAW" from the foot, this name being that of the mountain at the far side of the lake.

In Reply

B. Weir (Liverpool).—The lion on the Wembley stamps has been the subject of much discussion among philatelists. Some claim that it looks more like a mastiff! We certainly think there is room for improvement in the design.

S. Ward (Grimsby).—The Prince of Wales appears on several stamps, and a portrait of him in his young days is included in the series of Royal Family portraits issued by Newfoundland. The Prince is depicted on the 3c. stamp and Princess Mary on the 5c.

T. Martin (Manchester).—The triangular stamp to which you refer is a well-known stamp issued by the Cape of Good Hope. Prices of these particular stamps vary from 10/- to £240, which is the present catalogue price for a used copy of the 4d. vermillion, an error in colour as the correct colour is blue. We will deal with this stamp in a future issue.

N. Corlett (Brighton).—The 5c. Red Cross was issued by France on the ordinary 10c. stamp showing a sower. Monaco issued a 5c. Charity Stamp on the current 5c. issue.

L. Howard (Southampton).—The stamp you describe, showing a messenger on a bicycle, is a 10c. special delivery stamp issued by the United States.

B. Wentworth (Derby).—The figure represented is throwing the discus in the Olympic Games.

N. Davies (Douglas, I.O.M.)—The stamp you send is of no value—it is one of the common stamps recently issued and classed as "Neurope."

The Meccano Guild

A Great Fellowship of Boys

President: Mr. Frank Hornby, Managing Director of Meccano Ltd.

The Headquarters of the Meccano Guild are at the Head Offices of Meccano Ltd., Binns Road, Liverpool.

What the Guild Means The Meccano Guild is an organisation for boys, started at the request of boys, and conducted as far as possible by boys. In joining the Guild a Meccano boy becomes a member of a great brotherhood of world-wide extent, every member of which has promised to observe its three great objects; wherever he happens to be—even in strange countries—he will know he has met a friend whenever he sees the little triangular badge. The Meccano Guild is bringing together Meccano boys all over the world, and is helping them to get the very best out of life.

How it Commenced More than a million boys in Great Britain derive their greatest indoor pleasure from Meccano. Before the Guild was formed, hundreds of these Meccano boys wrote to us every week. They told us how they wished they could be put into communication with other Meccano boys and how they longed to be able to meet them. They asked if arrangements could be made so that their wishes might become an accomplished fact. We responded to their repeated and increasingly numerous appeals, and as a result the Meccano Guild came into being.

Why You Should Join Every Meccano boy should be a member of the Meccano Guild. All who have studied its objects must agree that the Guild cannot fail to have a profound effect for good on the lives of its members. It is ready to be of service to each individual member—to help or give advice whenever requested. At the head—guiding and controlling, and taking a personal interest in this great movement—is the President, Mr. Frank Hornby, Inventor of Meccano and Managing Director of Meccano Limited.

How to Become a Member

Individual membership of the Guild is granted to every boy possessing a Meccano Outfit who applies on the prescribed form and who promises to observe the objects of the Guild, and to wear his badge on all possible occasions.

The cost of the Guild membership badge is 7d. post free in the United Kingdom, but members abroad will be required to pay 5d. extra for registered postage, and stamps for the necessary amount should be sent along with the form of application. The Guild badge is beautifully enamelled in blue and is made for wearing in the lapel of the coat. Any boy wearing the Guild badge is at once recognised by other Meccano boys as a member of the great brotherhood of boys who have undertaken to live a clean, truthful and upright life. No introduction or ceremony is necessary between Guild members, who may be recognised at once by the badge they wear.

In addition to the badge, the President of the Guild presents each member on joining with a Certificate of Membership, measuring 7 inches by 9½ inches, and printed in orange and sepia. It is a replica of the large Club Certificate, and is intended to be framed by the Guild member and hung in his bedroom.

BADGE OF  MEMBERSHIP.

THE THREE GREAT OBJECTS OF THE GUILD

(1) To make every boy's life brighter and happier.

(2) To foster clean-mindedness, truthfulness, ambition, and initiative in boys.

(3) To encourage boys in the pursuit of their studies and hobbies, and especially in the development of their knowledge of mechanical and engineering principles.

Every boy who joins the Meccano Guild promises to observe these three splendid objects, and to do all in his power for their furtherance.

Meccano Guild Correspondence Club

All Meccano boys have similar thoughts, share the same pleasures, and are stimulated by the same ambitions. They long to tell other Meccano boys of their own schemes and ideas, and to exchange notes about Meccano model-building and all the other things in which boys delight. This is now made possible through the medium of the Guild Correspondence Club, which places members of the Guild in communication with other members in some other part of the country or abroad.

To those boys who are interested in foreign languages, the Correspondence Club provides a medium for their advancement in this respect, for correspondents can often be found for them in many foreign countries, particularly in France. For those who do not desire to correspond in a foreign language, but who wish to know something of the life of boys abroad, correspondents are found in the Colonies or in English-speaking countries. Full particulars of the Club will be sent on application.

MECCANO CLUBS. Meccano Clubs are founded and established by enthusiastic Meccano boys under the guidance of the Guild Secretary at Headquarters. At the present time there are over 100 active Clubs in various towns and villages in this country, as well as many Clubs Overseas and in foreign countries. Each Club has its Leader, Secretary, Treasurer and other Officials, all of whom, with the exception of the Leader, are boys. The Club's year is divided into four sessions, namely, Autumn, New Year, Spring, and Summer, and an appropriate programme is arranged for each session. The details of meetings, etc.—ranging from rambles, cycle-runs, and cricket matches to model-building competitions—are left to the decision of the Club Leader or the Club Committee.

If the nearest Club to you is too far away for you to join, or if you are unable to join for any other reason, consider the possibility of forming a new Club in your own district.

EXISTING BOYS' CLUBS

In many cases Meccano sections have been started by existing Clubs for boys, and they devote an evening a week to the hobby. The Guild makes no distinction between these Clubs and Clubs solely devoted to Meccano, and the Certificate of Affiliation is granted, provided that the boys are members of the Meccano Guild and conform to the Guild regulations—at any rate so far as the Meccano section is concerned. Meccano boys who are already members of such Clubs and who are desirous that an evening a week should be devoted to Meccano, should suggest this to the Secretary.



AFFILIATION CERTIFICATE

When a Club has been formed, has a recognised Club-room, an adult Club Leader and at least six members, the Leader applies for affiliation with the Guild. Subject to the approval of the President this is granted, and the Club is then able to avail itself of the privileges of affiliation. The Club is presented with the Guild Certificate of Affiliation with the Club's name inscribed on it. It is printed in orange and sepia, measures 23 inches by 18 inches, and is specially suitable for framing and hanging in the Club-room.

STARTING A MECCANO CLUB

A Meccano Club is usually started at the suggestion of some enthusiastic Meccano boy having friends who are also interested. The boys get together and decide to form a Club, following which they interview some adult and ask him to become their Club Leader.

At first the meetings may be held in the houses of the members, each of whom will perhaps take it in turn to entertain the Club. As a temporary arrangement this is to be commended, but the time comes when the members feel that the increased membership necessitates greater accommodation. The Club Leader and Secretary then approach some authority (such as a Church, Chapel, or School, or perhaps the local Y.M.C.A.), whom they know to have a suitable Club-room, arrangements are made and the room is taken. Perhaps a small rent is asked to cover heating and lighting, and this is covered by the Club subscription, which the members will be requested to pay, the rate per week being fixed by the Leader and the Committee. The authorities at the Church, Chapel, or School are often only too pleased to provide a suitable room and, where desired, to assist in the appointment of a Club Leader to guide and control the work of the members. The factor which counts most in the success of the Club is the enthusiasm and earnestness of the members themselves. No Church or School authority has yet resisted an appeal where the objects are so desirable and beneficial as those of the Meccano Guild, if the appeal is properly presented.

In all these arrangements the Guild Secretary at Headquarters renders every assistance, writing where necessary to the local authorities, and doing all he can to help the formation of the Club.

Those who contemplate starting a Club should write to the Guild Secretary, and on receipt of 2d. in stamps to cover postage, he will send them a copy of " How to Run a Meccano Club," a special booklet of helpful suggestions.

THE GUILD RECRUITING CAMPAIGN. The President wants every Meccano boy to be a member of the Guild, and wishes every member to do his utmost to help to make the objects of the Guild widely known. With this end in view a special Medallion is presented to each member of the Guild who obtains three new recruits, and an additional mark of merit is given when nine more members are recruited. Full particulars of the Recruiting Campaign will be sent on request.



SPECIAL MERIT MEDALLION
(*Reverse*)

SPECIAL AWARDS TO CLUB MEMBERS

Every encouragement is given to members of Clubs to do good work and to prepare short lectures or papers on subjects in which they are particularly interested. The experience and confidence in himself a boy thus gains in standing up before his friends and reading a paper of his own composition will prove invaluable to him, and to still further encourage this excellent work, a Special Merit Medallion is allotted to each club and awarded to the member who delivers the best paper. Further particulars of this scheme may be obtained from Headquarters.



SPECIAL MERIT MEDALLION
(*Obverse*)

HOW TO JOIN. Intending members should write to the Secretary of the Meccano Guild, Binns Road, Liverpool, asking for a membership form; this should be signed and returned to Headquarters with remittance of sevenpence if they live in the United Kingdom, to cover cost and postage of the Guild Badge and Certificate, or one shilling to cover the extra postage if they live abroad. On receipt of these applications, they will be enrolled as members of the Guild.



RECRUITING MEDALLION



The Secretary's Notes

Models for Exhibitions

At this period of the year I receive many requests from Club Leaders and Secretaries for advice as to the best method of making an Exhibition pay. In some cases it is desired to hold only a Club Exhibition, for the purpose of raising funds for purchasing additions to the Club's Meccano or Sports Outfits, or for starting some new feature such as an Air Rifle Shooting Section. In other cases the object is to take part in a bazaar or other effort to raise funds for some local church or charity. Every Meccano Club is capable of producing an interesting layout of Hornby Trains and various Meccano working models, and the inquiries I receive usually take this form :— "Which Meccano models can be used to provide a paying side show?" There are several models that can be usefully employed for this purpose, but the two that have proved most successful in actual practice are the Silhouettograph (Model No. 634) and the Meccanograph (Model No. 708).

How to use the Silhouettograph

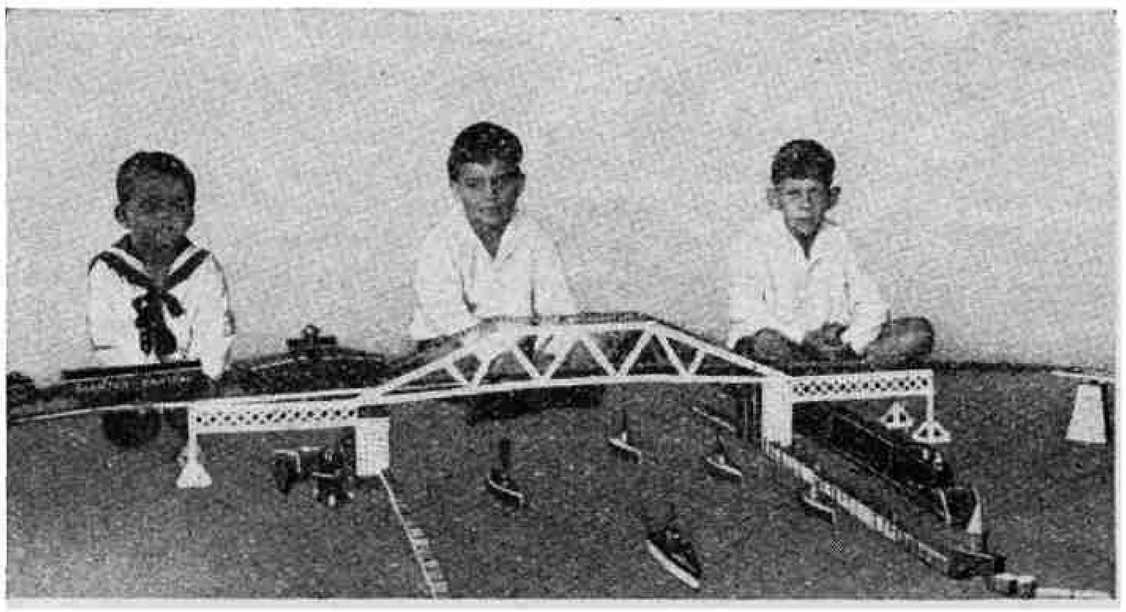
The Silhouettograph invariably proves a great attraction, and by charging a small fee for each person to be silhouetted, quite a considerable sum may be collected. The writing arm is extended by means of 11½ inch Axle Rods and Couplings for a distance of roughly 3 ft. The person whose head is to be drawn is asked to sit with his profile exactly opposite the writing board, which should be a smooth piece of wood or very stout cardboard. The outer end of the writing arm is then passed steadily round the profile, while a piece of pencil lead, secured in a coupling on its other end, executes a likeness upon a sheet of paper pinned to the writing board. The pencil is held against the paper by slight pressure exerted through a spring. With a little practice quite good results may be produced, and it is surprising how eager people are to be silhouetted when they have seen the likenesses obtained by their friends.

Meccanograph Designs

Little need be said about the Meccanograph. Its popularity is remarkable wherever it is exhibited, and it is frequently the means of opening people's eyes to the wonderful possibilities of the Meccano system The attention of passers-by should be first attracted by means of a few elaborate designs placed in a conspicuous position. These designs are much more striking if they are executed in different coloured inks or worked up with water colours. Once interest has been aroused, it is generally quite easy to persuade people to pay a small fee to make a design of their own, and it is a common thing to see people become so fascinated by the machine that they make quite a number of designs before they can tear themselves away!

Simple Competitions

In addition to these models, simple competitions may be made a source of small, but useful profit. A very successful scheme is to fill a glass jar with Meccano Nuts and Bolts and invite people to guess the exact number in the jar. A small charge is made for each guess, and a small prize is awarded to the one guessing the exact number, or if, as is extremely likely, nobody guesses the correct number, to the attempt coming nearest to it. Another useful competition on similar lines consists of fitting up a model and inviting people to guess the total number of holes in the strips composing it, or the number of Nuts and Bolts used in its construction.



Three Dutch Meccano Boys enjoying a Merry Christmas

Davenport (Stockport) M.C.

The Davenport (Stockport) M.C. was formed in November, 1922, and in April, 1923, became affiliated with the Guild. Last autumn the Club assisted at a bazaar in aid of the funds of the local church, and made £25 by exhibiting a complete layout of a Hornby Railway together with various Meccano models.

Great keenness has always been shown by the Club to view as many local factories and works as possible on the principle that "seeing more is learning more." During the summer months members keep together by arranging cycling tours and camping out, and last year the Leader, Mr. Main—a most energetic and enthusiastic worker—took the boys to camp for their holidays. Such outings are always popular, and it is hoped that similar arrangements will be made this summer if we are favoured with any!



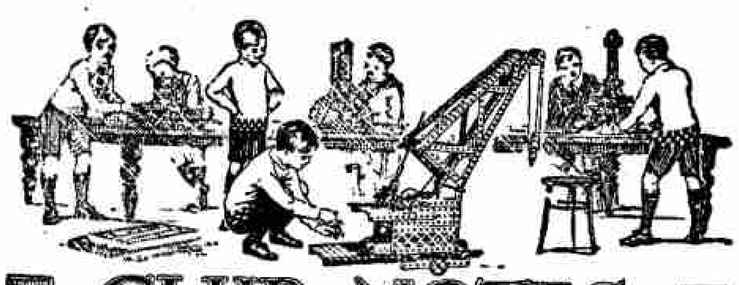
Our photograph shows some of the members on an outing last summer.

Forming Lasting Friendships

Week by week, I receive letters from members of the Guild Correspondence Club showing the valuable work the Club is doing in regard to building up lasting friendships between Meccano boys in all parts of the world. A recent illustration of this is afforded by the case of an English boy and a Dutch boy. These boys corresponded regularly for two years, and although they had never seen one another, such a strong friendship sprang up that the Dutch boy's parents invited the English boy to spend a holiday with them. The English boy did so and had a most delightful time, and now that the two boys have become personally acquainted they are the greatest possible chums. But for the Guild Correspondence Club it is certain that these boys would never have heard of each other. Such instances as this are by no means rare, and I urge all Guild members to consider seriously the idea of joining the Club this year.

Girls and Meccano Clubs

During the past few months I have been very interested to note the rapidly-growing number of girl Meccano enthusiasts. Many of these girls have already joined the Meccano Guild, but others appear to have an idea that they are not permitted to become members. I wish to take this opportunity of stating that this is not the case. Girls have as much right as boys to join the Guild, and I shall welcome their applications for membership. There is also not the slightest reason why girls' Meccano Clubs should not be formed and run satisfactorily. The larger clubs might consider the possibility of following the example of the Claygate Club in having a separate section for girls. The girls' branch of this club has over 30 members. If this idea appeals to any Club Leader I have no doubt the Leader of the Claygate Club, Mr. Haynes, would be glad to give any information.



CLUB NOTES

Washingboro' M.C.—Meetings have been held recently in the Leader's house, owing to the Village Hall not being available, but very soon a suitable club-room will be obtained where Mr. R. Hamblett will fix up his wireless set. Lectures on Motor Cycling and tuning for speed have been arranged. Club roll: 16. *Secretary*: T. Smith, 3, Stamford Villas, Washingboro', Lincoln.

South Park (Ilford) M.C.—Members are very enthusiastic model builders and some good models have been built, including the Loom on which the builder has woven several neck-ties. Other points of interest are Lantern Lectures and an Exhibition. Club roll: 45. *Secretary*: Norman Tweddell, 103, Breantore Road, Seven Kings, Ilford.

Chalmers Church (Alloa) M.C.—Has now become affiliated with the Guild and members are very enthusiastic. An interesting syllabus has been arranged, including Model Construction, Lantern Lectures, and Musical Evenings with Tea and Exhibition of models. Club roll: 24. *Secretary*: Wm. Henderson, c/o Mr. Meins, 1, Hawkhill Cottages, Clackmannan Road, Alloa, Scotland.

Holy Trinity (Blackburn) M.C.—Very successful meetings have been held and the membership is steadily increasing. Great keenness is shown in the club's football team, and some excellent games have been played. The Leader, Mr. Hulme, gave a lecture on the "*Steam Engine*," which he illustrated by a model constructed by himself. Club roll: 28, average attendance, 20. *Secretary*: H. Jepson, 11, Pine Street, Blackburn.

St. Mary (Bourne) M.C.—An interesting lecture was recently given by Capt. Purvis, R.N., on "*The History of our Ships*," and there was a good attendance. Model building is one of the chief features in the club's activities. Club roll: 16. *Secretary*: Douglas L. White, "Rosedale," Stoke, Andover, Hants.

Combe St. Nicholas (Chard) M.C.—The session has been the most successful ever experienced, and the members' subscriptions for last year left a surplus to carry over to this year for club improvements. Another model competition is being arranged. Club roll: 15. *Secretary*: L. Bailey, Combe St. Nicholas, Chard, Somerset.

Buckfastleigh (Devon) M.C.—Is unfortunately without a club room owing to the building where the room was situated being partially demolished. Members are anxiously looking out for another room, and if anyone knows of a suitable room will he please communicate with the Secretary. Club roll: 26. *Secretary*: H. J. Parsons, Bell House, Fore Street, Buckfastleigh, S. Devon.

Rosyth M.C.—Model building continues to be a popular feature. It has been decided to arrange a Members' Party, the expenditure upon this to be met mainly from Club funds. Club roll: 9. *Secretary*: Edward Hunter, 79, Admiralty Road, Rosyth, Fife.

Glevum (Gloucester) M.C.—Members, who are all Boy Scouts, recently assisted in an Operetta in aid of the Missionary Societies, and have been kept very busy preparing for a Christmas Pantomime. A Gymnasium Class is held each Saturday evening, and other events are Wireless Evenings, a Jumble Sale, and visits to different works, etc. Club roll: 20. *Secretary*: C. L. Wilks, 89, Regent Street, Gloucester.

Rolleston M.C.—Has been reorganised into Senior and Junior sections. The two sections meet once a fortnight in the Senior Room for lectures, but should the smaller boys not wish to listen they can play games, build models, etc. A wireless valve set has been purchased from funds raised at the last Exhibition and Concert. Mr. Taylor, a local gentleman, recently gave an interesting lecture on "*Astronomy*," which was greatly appreciated. Club roll: 23. *Secretary*: E. P. Toon, Sherbourne House, Tutbury Road, Rolleston, Burton-on-Trent.

Great Baddow (Chelmsford M.C.)—Keen interest is shown in constructing models, and the most recent efforts include a Crane, Pit Head Gear, and Fire Escape. The club became affiliated with the Guild in December, and promises to be very successful. Club roll: 10. *Secretary*: G. T. Kemp, 5, King Edward St., Beehive Lane, Baddow Road, Chelmsford, Essex.

Loanhead M.C.—Recent activities included a Magic Lantern Entertainment and a Lecture by the Leader on the "*Motor Car*," explaining the working of the engine. Club roll: 18. *Secretary*: B. Warnock, R.P. Manse, Loanhead, Midlothian.

Peebles M.C.—The Leader, Mr. Flint, has done admirable work for this club, and recently obtained a new club-room from the local Y.M.C.A. free of charge. One night each month is set aside as a "Talk Night," when the Leader reviews the articles appearing in the "*M.M.*" Meetings are held every Tuesday. Club roll: 7. *Secretary*: A. Ker, 1, Ker Place, Peebles, Scotland.

Liscard High School M.C.—Many new members have recently joined, and the club has again been divided into three sections, Photographic, Wireless and Meccano, owing to the popularity of this system last session. Each subject is illustrated by models built by members, and special demonstration evenings are held. A Social Evening and Dance is also included in the club's winter activities. Club roll: 65. *Secretary*: A. B. Warburton, 11, Brisbane Avenue, New Brighton.

Meccano Club Leaders

No. 18. Mr. R. Patrick



In addition to being the leader of the Glenelg (South Australia) Meccano Club, Mr. Patrick is also the local Meccano dealer. He can claim a long and intimate acquaintance with the hobby, and his knowledge is of considerable assistance to the Club members.

Glenelg is the chief watering-place of South Australia, being 6¾ miles from Adelaide, and it has many historic associations. The Meccano Club was first started in July 1923, with a membership of sixteen. Mr. Patrick then took over the Leadership, and affiliation with the Guild was granted early last year. Since then the number of members has increased to 63, and the Club has been divided into two divisions, junior and senior, under sub-leaders.

Mr. Patrick is an able lecturer and his talks on Club nights are eagerly looked forward to, while his great popularity with boys is evident from the steadily increasing number of Club members.

Boroughmuir School M.C.—Members propose to pay monthly visits to such places as the Leith Docks, printing works of the "*Scotsman*," Rosyth Dockyard, the Rubber Mills, and various other interesting places. After each visit it is proposed that a club member shall read a paper on the various features seen. An interesting lecture was given by Mr. Fraser on "*A Visit to the Canary Islands*," illustrated by lantern slides. The membership increases steadily. Club roll: 42. *Secretary*: James D. Watson, 1, Alvanley Terrace, Edinburgh.

Luton M.C.—Great interest is shown in Wireless Telegraphy, and recently members brought their wireless sets to the club-room and demonstrated them. Other activities include lectures on Telegraphy, Magnetism and Electricity, and the First Cable. Lectures have become so attractive that it is proposed to hold them more frequently. Club roll: 26. *Secretary*: L. Goldsmith, 69, Tennyson Road, Luton, Beds.

Ellesmere Port M.C.—A Wireless Set constructed by members has been tested and has given good results. Model Building and further Experiments in Wireless figure in the interesting syllabus. Club roll: 22. *Secretary*: W. H. Hope, 41, Princes Road, Ellesmere Port, near Birkenhead.

Chard M.C.—An Exhibition was held in December, at which some very interesting models were displayed, including a Dredger, Motor Bus, and Roundabout. A local gentleman judged the models and distributed the prizes. Other activities include a Model Building Competition. Club roll: 16. *Secretary*: Wm. Sanders, Stamford House, Upper Combe St., Chard.

King Edward's School (Birmingham) M.C.—Last session a few meetings had to be postponed owing to the production of a school play, but next term it is hoped to make good headway. A new Secretary will shortly be appointed, as Master Robertson has resigned to become Secretary of a new club, called the Handsworth M.C. Club roll: 16.

Victoria (Glasgow) M.C.—Was recently divided into Senior and Junior sections, and this arrangement has proved quite satisfactory. An interesting lecture was given by A. Boggs on "*Wireless Telegraphy*," on which occasion the committee of the newly-formed Govan Meccano Club were present. Club roll: 39. *Secretary*: T. Calderwood, 63, George Street, Whiteinch, Glasgow.

Bromley County School M.C.—Members are now busy fitting the lifts in their model of the Eiffel Tower, which are intended to work automatically. E. Taylor gave a very interesting lecture on "*Lighthouses*," and it has been proposed to have more lectures in future. Club roll: 10. *Secretary*: H. Seale, 14, Broadway, Bromley.

Boston (Lincs.) M.C.—Recently had a "prize-giving" night, when prizes were presented by a local gentleman, Mr. French, for the best Meccano and Fretwork models. G. Harvey's Motor Chassis was considered the best model, and A. Read won a prize for a Fretwork bracket. Club roll: 30. *Secretary*: R. Robinson, 30, Woodville Road, Boston, Lincs.

Accrington M.C.—An interesting lecture on "*Cotton*" was given by Mr. Airey, who explained the different processes through which cotton passes from the time it leaves the plantation until it is made up into material. Other activities during last month included Wood and Cardboard Model Making, and an Essay on "*My Favourite Hobby*." Club roll: 22. *Secretary*: V. Waterhouse, 45, Ramsbottom Street, Accrington.

India

Delhi Children's M.C.—Became affiliated with the Guild in November to the delight of all members. Steady progress continues to be made, and the club's prospects are bright. *Secretary*: Mr. R. Raman, Children's M.C., Charkhe Walan, Delhi, India.

South Africa

Malvern M.C.—Members have held a "Pound Day" in aid of the Children's Home, and a Garden Fete in aid of the Home and the Club Building Fund, and it was hoped to make at least £100. Further activities include Model Building, Games, Lectures and Concerts. Club roll: 31. *Secretary*: C. Gunnell, 177, St. Frusquin St., Malvern, Johannesburg, South Africa.

Clubs not yet Affiliated

Caulfield (Melbourne) M.C.—Has been established only about four months, but has already become a strong club. A very successful Exhibition was held in connection with a Church Fete. Club roll: 14. *Secretary*: Neil Brown, 89, Eskdale Road, Caulfield, Melbourne, Australia.

Norbury M.C.—Members have recently concentrated on recruiting, and the numbers are increasing week by week. Meetings are held in St. Philip's Hall, kindly lent by the Church authorities. Efforts are being made to form a library, and to persuade local gentlemen to give lectures. Club roll: 23. *Secretary*: W. R. Leader, 70, Norbury Crescent, Norbury, London, S.W.16.

Handsworth (Birmingham) M.C.—Will shortly become affiliated with the Guild. The Leader, Mr. Allan, is very enthusiastic and hopeful of a successful year. *Secretary*: N. J. Robertson, 30, Hinstock Road, Handsworth Wood, Birmingham.

Walthamstow M.C.—A club has recently been formed at Marsh Street Congregational Church, and all boys wishing to join should communicate with the Secretary: C. Redfern, 34, Church Hill Road, Walthamstow, London, E.17.

Proposed Clubs

Watford M.C.—Arthur Paskell, 1, Platts Avenue, Watford, is anxious to form a club and would like to hear from Meccano boys wishing to join. An adult Leader and a club-room are urgently needed.

Dublin M.C.—It is hoped shortly to establish a club in Dublin if a club-room can be found. Any information regarding a suitable room will be gladly received by the Leader, Mr. Kidney, 73, North Circular Road, Dublin, or D. J. Scannell, 25, Star of the Sea Terrace, Sandymount, Dublin.

Keighley (Yorks.) M.C.—Efforts are being made to form a club in Keighley, and an adult Leader is required. All Meccano boys interested are asked to write to H. Haygarth, 7, Raven Street, Keighley, Yorks.

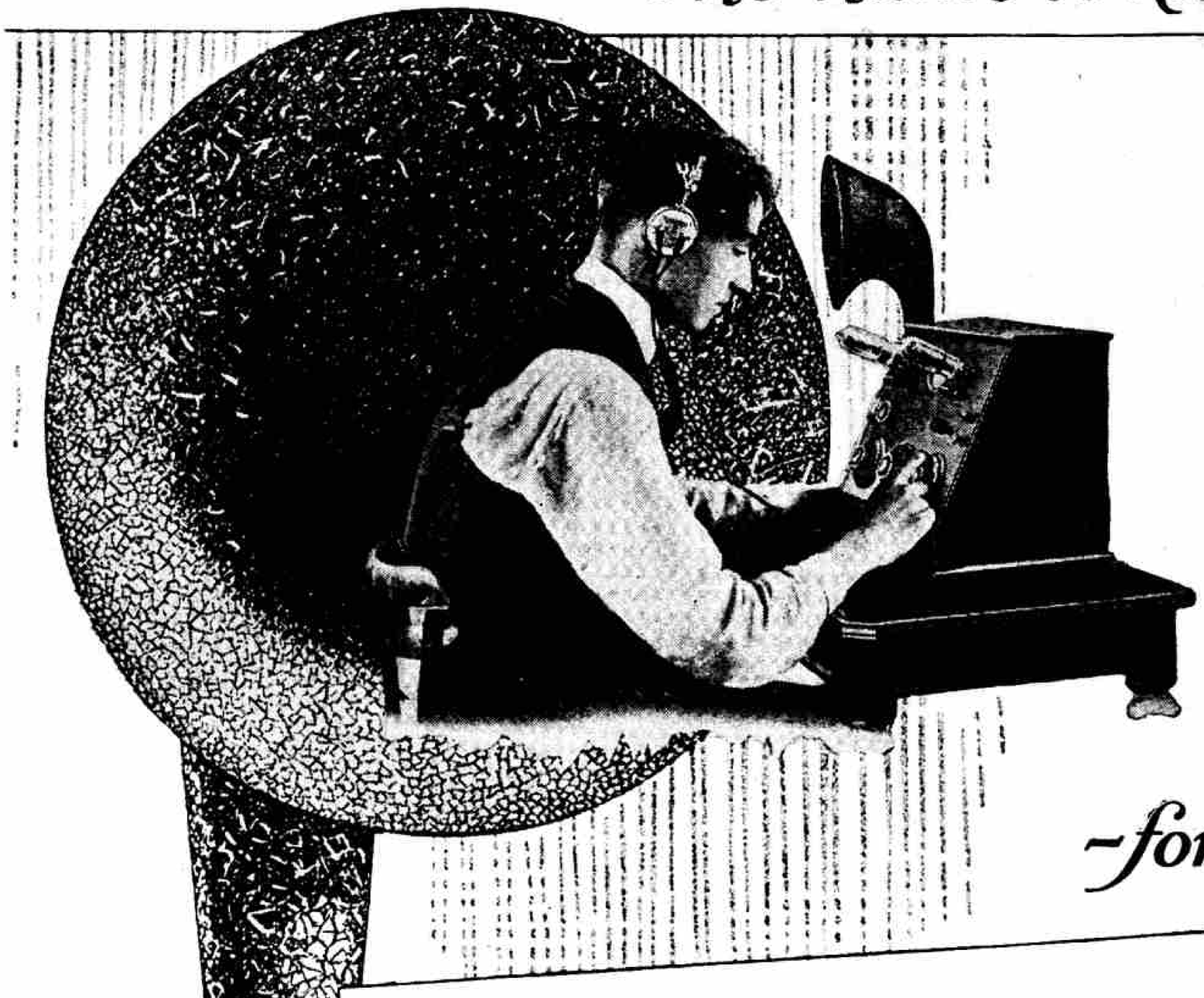
Aylestone Park (Leicester) M.C.—All boys interested in Meccano and wishing to form a club in the district are requested to get into touch with S. Buxton, 36, Lothair Road, Alyestone Park, Leicester.

Newcastle Model Engineers, M.C.—Strenuous efforts are being made to start a club in Newcastle, and Mr. B. Gilbey, 205, Back Welbeck Road, Byker, Newcastle-on-Tyne, who is willing to become Leader, appeals to all boys interested to communicate with him. A club-room is urgently needed.

Siena (Italy) M.C.—It is proposed to establish a club in Siena. Mr. Bruchi has kindly consented to be the Leader, while his son, Valentino Bruchi, 39 Via Ticasoli 39, Siena, Italy, will carry out the Secretary's duties.

Brandes

The name to know in Radio



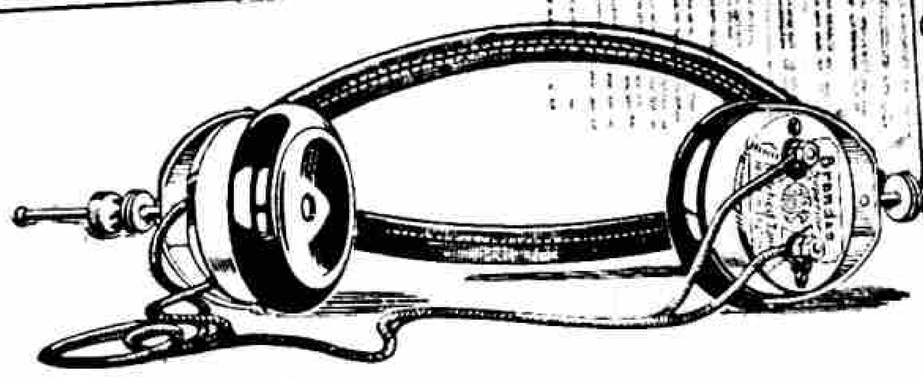
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–for Young Bill

The fever of the experimenter has fired young Bill's ambition. In the picturesque vernacular of our American friends he's "cottoned on to the hull bunch"—vacuum tubes, hook-ups, new wave bands, right down to the last binding post. He tunes in the distant stations now with his *Matched Tone* Headphones, and is content. They bring in the faintest signals, their delicate supersensitivity making them unexcelled for long range telephony.

And the *Table-Talker* is just fine. To his credit, Bill refuses to acknowledge the family's praise. "It's not me tinkering about," he says, "the *Table-Talker* always came through as if you were actually in the studio, and with no scratchy notes." *Ask your Dealer for Brandes.*

Tune the Table Talker 42/-



– with the Matched Tone Headphones 25/-

Wireless Helps Navigation

Position-Finding by Radio

DURING recent years great advances have been made in finding the position of a ship by means of radio. The method is used when, owing to cloudy weather, the ship has been unable to obtain her position from the stars for several days, or when the ship is near a coast in a fog and it is essential to know the exact position. The method is also much in use for finding the position of aeroplanes engaged in the cross-Channel flight to France. The principles of position-finding both at sea and in the air are similar, and as they are of general interest and of growing service we propose to describe them briefly.

If a rotating frame aerial is used for receiving wireless messages it is found that the messages are loudest when the aerial is pointing " end-on " to the sending station. When the aerial is at right angles to the direction of the signals they disappear almost entirely. In modern practice it is not necessary to revolve the actual aerial, however, for the necessary adjustment may be made in the apparatus of the receiving set by moving only a small part.

The bearings of two known stations are obtained by a ship in this manner and the results plotted on a map. The position of the ship may then be found quite easily. In the accompanying diagram A and B are the known positions of two shore stations and C is a ship requiring to find her position. Supposing that from the ship C, station A is found to be due south and station B is E.S.E. If the line AC is drawn on the map due north from A, and BC W.N.W. from B, the place where the two lines cross is the position of the ship. In practice it is advisable to choose the stations A and B so that the lines AC and BC cut the coast at as sharp an angle as possible, since if the angle is very acute considerable deflection is probable.

Compass Stations

Another method is for the stations A and B to be fitted with direction-finding apparatus and for them to find the bearings of the ship C. The result obtained by station B is telephoned by land-line to station A, where the results are plotted on a map. Station A then transmits by wireless the result to the ship in terms of longitude and latitude. This method is used every day in connection with aeroplanes on the cross-Channel route, the two stations employed being Croydon and Paulhan. The result of the plotting is wirelessed to the aeroplane, the aviator being told that he is now over such-and-such a village, or so many miles from some well-known landmark.

In this method it is necessary for the shore stations, known as " compass stations," to be informed by the ship or aeroplane that the position is required, and all other radio activities of the station must be stopped while the bearings are being obtained.

The Chief Compass Stations

In the case of ships this " shore-station " method has one drawback. If the area over which the compass stations work is a large one, there may be a number of ships requiring bearings at the same time. In this case the various ships have to wait their turn, which often causes considerable delay. On the other hand, a ship fitted with a direction-finder can obtain her position from any two stations, whether compass stations or otherwise, without troubling them, provided they are transmitting at the time. This method permits any number of ships to obtain their respective positions at the same time, while the two land stations transmit their usual messages unhindered.

The more important ship compass stations in the United Kingdom are Amlwch (call sign BXV), Berwick (BVG), Carnsore (BVZ), Flamborough (BVN), Larne (BXJ), Lizard (BVY), Malin Head (GHM), Peterhead (BVL), Rhyl (BZW), and Seaview (BXK).

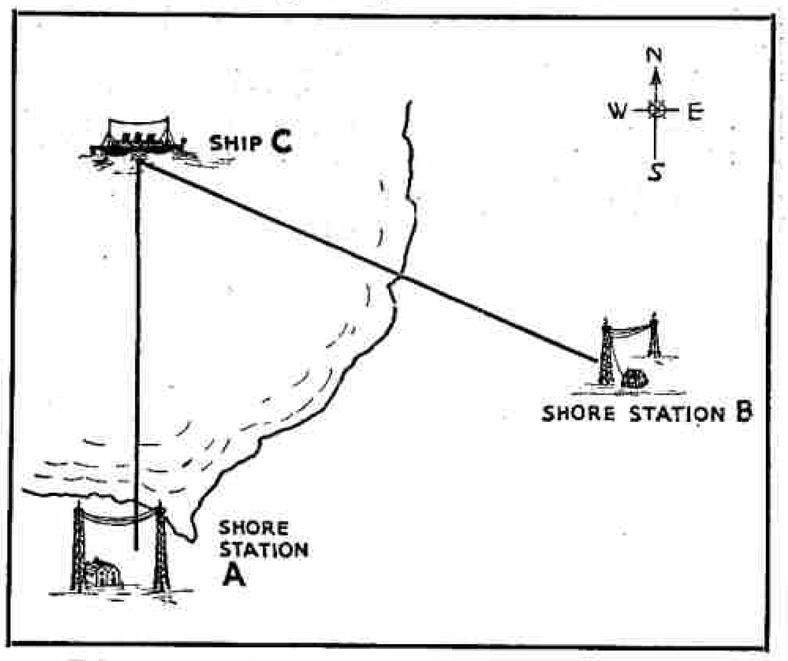


Diagram illustrating the method of finding position of a ship with the assistance of two shore stations.

All these stations are controlled by the Admiralty, with the exception of Malin Head, which is under the Post Office. All transmit on a wave length of 450 metres (except Malin Head, which is usually 600 metres, but sometimes 300 metres) and most of the stations work in pairs.

Under-Water Radio

Recently a third method of finding a ship's position in fog has been introduced at the Maas light-ship, which sends signals through the ether and the sea simultaneously. The signals travel through the ether at the speed of light, but through the water their speed is only 4,700 ft. per second. By measuring the difference between the times of arrival of the same signal sent by these two routes the distance of the lightship can be found with a fair degree of accuracy. For instance, if the under-water messages arrive one second later than the ether messages, the lightship is 4,700 ft. distant; if two seconds later, 9,400 ft. distant, and so on. The bearing is obtained in the usual way, by means of direction-finding apparatus, and from the two factors of direction and distance the position is plotted on a map.

Aeroplane Finds Ship at Sea

The remarkable accuracy that may be attained in wireless direction finding is well demonstrated by an experiment recently described by Dr. J. Robinson :—

" A test of the method was made some time ago by having a ship transmitting at sea out of sight of land. An aeroplane started from Biggin Hill, in Kent, without any information, except that it had to find the ship, which would transmit a particular signal every few minutes. The ship might have been in the English Channel or in the North Sea, but the observer, immediately on getting into the air at Biggin Hill, gave the pilot the correct course, and the aeroplane was flown straight to the ship, which was some 10 to 15 miles south of Brighton. The course followed from Biggin Hill to the ship was not deviated from in any degree. It should be noted that in this particular case visibility was very bad, and the pilot was within two miles of the ship before he observed it."

Submerged Electric Cables Guide Ships

A few years ago a cable was laid on the sea-bed of New York harbour and through the harbour entrance. An electric current passes through this submerged cable and causes a note to sound in a telephone on all ships fitted with suitable receiving apparatus coming within two miles of the cable. The nearer the ship is to the cable the louder are the signals, and when these are at their maximum the ship is directly over the cable. In this manner ships are able to follow the course of the cable and enter the harbour in safety, even in the densest fog.

The French port of Brest has installed a similar cable and it is hoped to have the device at all French ports within a short time. It is proposed also to lay such a cable across the English Channel, so that the cross-Channel services will not be hindered by fog. The system is equally practicable for aircraft, and will prove useful for them if it is installed on land as well as on sea.

Guiding Aeroplanes to Earth in Fog

Cables will be used in a somewhat similar manner at the Croydon Aerodrome in connection with a series of experiments to be carried out with the object of finding a satisfactory solution of the difficult problem of guiding aeroplanes safely down when, owing to the landing ground being hidden by mist or fog, the pilot is unable to see to land in the ordinary manner. From electric cables laid across the aerodrome will be radiated upward a very powerful electric field by which apparatus in the aeroplanes flying above will be influenced.



The Story of Metals

1. COPPER.

IN the first instalment of our articles "*The Story of Iron and Steel*" we saw that the history of mankind may be divided into three great epochs, according to the nature of the tools and weapons used in each. First there was the Stone Age in which the use of metals was unknown, at any rate until the later stages of this epoch, the implements and weapons being made chiefly from bones, stone, and flint. Then followed the Bronze Age in which bronze, a metal composed of copper and tin, began to be employed and gradually came into general use. Last came the discovery of the art of smelting and working iron, and so the Bronze Age passed and the Iron Age came.

Copper Known Long Before Iron

From this it will be seen that copper was known and used at a far earlier period than iron, and the reason for this is not difficult to understand. Iron, although one of the most widely diffused metals, is never found in a pure state—except in meteorites—and the ore is not easy to recognise or to work after it is once found. On the other hand, copper usually occurs in a fairly pure state, and as with gold and silver, would attract the attention of pre-historic man on account of its brilliant colour. In addition to this, copper is very easily worked, far more so than iron.

It is, of course, impossible to say how or when the art of smelting copper was discovered, but Lord Avebury suggested that it came about in the later stages of the Stone Age through the accidental use of copper ore stones in the fire-pits built for cooking purposes.

Copper Used 10,000 Years Ago?

Bronze, as we have seen, is a mixture of copper and tin, and it appears likely that the real Bronze Age was preceded by a period in which pure copper was the only metal known and used. Possibly bronze was first produced by accident during the smelting of copper ores along with which were ores containing tin. Assuming that this was the case, it is natural to suppose that prehistoric workers would soon notice that the resulting metal was a great improvement as regards hardness, and further experiments would no doubt make it clear that this improvement was due to the presence of tin. It may be mentioned here that brass appears to have been unknown to early man, the first definite reference to this metal indeed dating only from Roman times, and therefore the early written references to brass probably really apply to bronze.

From various kinds of evidence available it appears probable that copper and bronze were in use to some extent as far back as ten thousand years ago—that is long before the commencement of written history. Certain Egyptian relics of copper and bronze are believed to date back 7,000 years, and there is evidence that copper tools were made in Ireland about 2,500 years B.C. The ancient Greek and Trojan warriors used copper for their swords and spearheads.

Origin of the Name

According to the historian Pliny, the Romans obtained their supplies of copper from the island of Cyprus. The metal was known to them as "*aes cyprium*," which was afterwards corrupted into "*cuprum*," from which our word copper is derived.

Little is known about the production and working of copper until the year 1556, when Agricola published a book entitled "*De Re Metallica*," giving details regarding the metallurgical processes of the period. It is recorded that Edward III. granted to a company of adventurers the right of working "the copper mines of Skildane in Northumberland, and the copper mine of Alston Moor in Cumberland, and the copper mine near Richmond in Yorkshire, during a term of 15 years, and on payment of a royalty to himself of one-eighth and one-ninth to the Lord of the Soil." In Queen Elizabeth's time there was a rich copper mine at Keswick in Cumberland, of which the Queen deprived the Earl of Northumberland on the ground that it was a mine-royal. It is recorded that 4,000 men were employed at this mine, but this number is probably exaggerated.

Smelting in South Wales

The first copper ores to be smelted in South Wales came from Cornwall, from the mines of the Mines Royal Company established by Queen Elizabeth. At Neath, copper smelting was in operation at least as early as 1585. During the 17th century the industry prospered greatly in the Neath district, and at the end of that century several copper works were in operation. The conditions in the district were particularly favourable for smelting operations, for there existed close together the richest copper mine in the kingdom, an ample supply of suitable coal, and the necessary refractory materials, including the famous Dinas rock, for the construction of the smelting furnaces. In addition to all this, the neighbouring coast was well supplied with safe harbours.

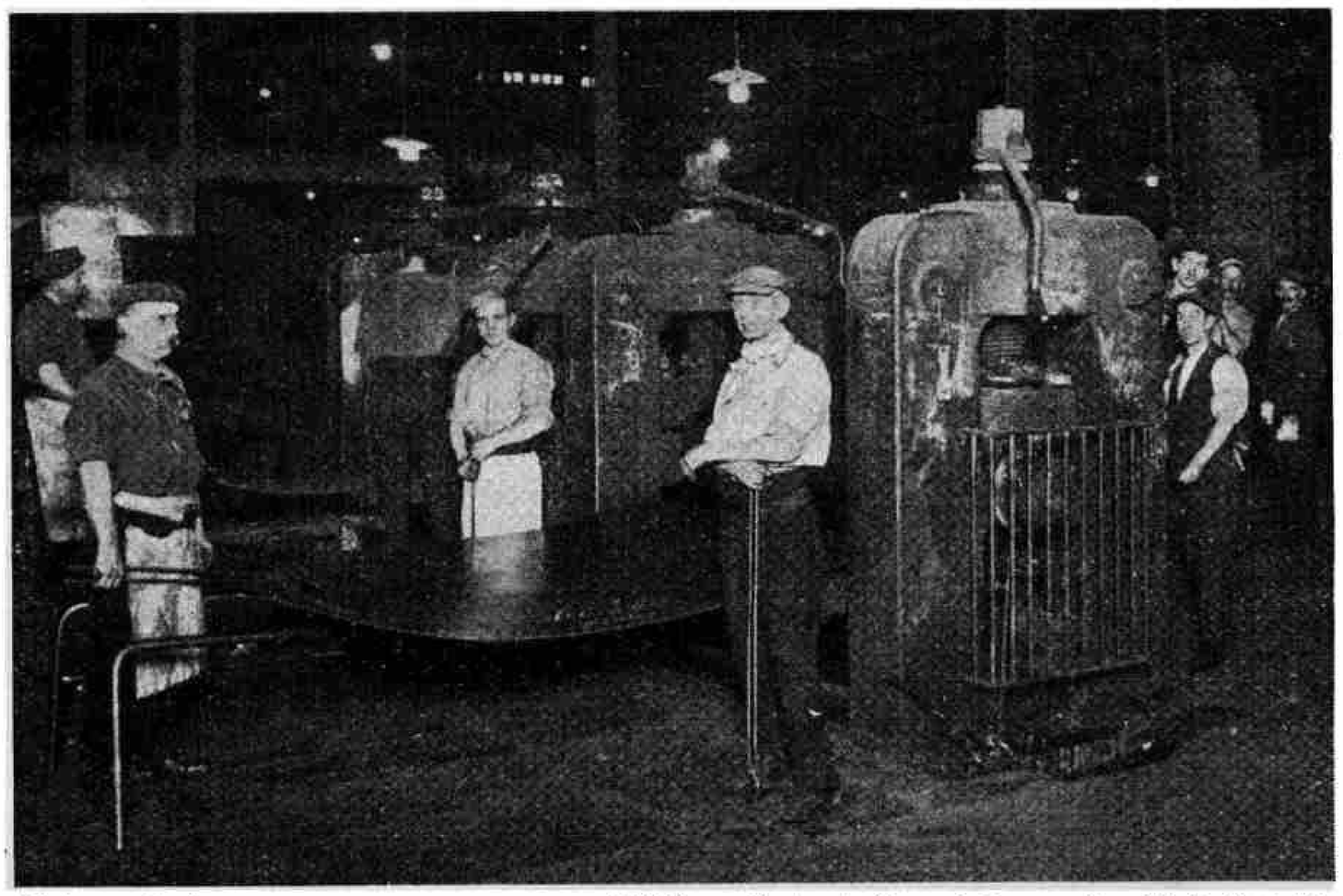


Photo courtesy] [*Williams, Foster & Co. and Pa coe, Grenfell & Sons Ltd.*

Rolling Copper Sheet

Neath had become a well-known smelting centre before the erection of furnaces at Swansea was sanctioned. A document, dated the 26th September, 1720, contains the following extract:—"Wee, the Portreeve, Aldermen and Burgesses of the Burrough of Swansey in the County of Glamorgan, doe hereby certifye all whom it may concern that wee doe approve of the erecting of a Copper Worke. . ."

During the 18th century copper ores were smelted in various other parts of Britain, but at the close of that century and in the early years of the 19th century no other centre was able to challenge the dominating position of Swansea.

Distribution of Copper Ore

In the early part of the last century about 7,000 tons of copper were produced annually in England from English ores, this amount being approximately 75 per cent. of the world's production.

England retained her leading position up to about the middle of the century, when the opening up of large ore deposits accompanied by great development of metallurgical operations abroad, brought about the production of large quantities of copper outside this country. The copper resources of Chile were developed about 1830; twelve years later the Australian mines were opened up, and in another two years the Lake Superior deposits were discovered. In 1860 the Spanish and Portuguese ores came into a position of great importance on account of the discovery of suitable methods of treatment.

Recent developments in copper smelting commenced about 1880, when the rich deposits at Butte, Montana, U.S.A., were discovered, followed shortly afterwards by the discovery of copper in the Yukon district and elsewhere. About the same time deposits were discovered in Queensland, Siberia, and the Katanga regions of the Congo.

Characteristics of Copper

Next to iron, copper is the most important of all metals. It is distinguished by its peculiar red colour. It has exceptionally high conductivity for both heat and electricity, being surpassed in these respects only by silver. It can be rolled into the thinnest sheets or drawn into the finest wire with comparative ease, and forging operations can be carried out on either the hot or the cold metal. The tenacity of cast copper ranges from 10 to 13 tons per square inch—as compared with aluminium 5 tons and pure iron 18 tons—but cold-working, such as rolling, hammering or drawing, may more than double the normal tenacity.

At ordinary temperatures copper is not attacked either by dry or moist air, but moist air containing carbonic acid gas causes the production of a green film known as verdigris. This film appears to act as a protective coating, quite unlike the film of rust on iron, which rapidly corrodes through the metal. Ancient specimens of copper and bronze that have been excavated show a coating of this green film.

An Old Legend

We have all heard how the alchemists of olden times sought to bring about the transmutation of metals—that is to change one metal into another, and in particular to transform the commoner metals into gold. They resorted to all kinds of schemes to justify their theories, and made use of the water of a certain river in Hungary, which was found to convert iron immersed in it into copper. There was really nothing at all mysterious about this, however. The river and its tributaries passed through districts containing deposits of copper, and a small amount of the metal was taken into solution. Upon the insertion of iron in the water, metallic copper was precipitated from the solution and the iron dissolved.

This same principle is used to-day on a large scale in the treatment of certain low-grade copper ores, and in this connection it is interesting to know that considerable quantities of copper have been recovered by guiding drainage waters from the old copper slag heaps in Swansea through channels in which scrap iron was deposited.

The Most Important Ores

Copper is obtained from minerals that are widely distributed throughout the world. Native copper is comparatively rare, the chief sources of commercial importance being the deposits of the Lake Superior region in northern Michigan. Huge masses of the metal weighing many tons have been discovered in this region lying on the surface of the ground. In Minnesota in 1854 forty men were engaged for a whole year in cutting up a single mass of copper weighing about 500 tons.

The most important oxide ores of copper contain the metal in the form of bright green "malachite," or the azure blue "azurite." Malachite, besides being a source of copper, is of interest on account of its extensive use for the manufacture of ornaments. The cathedral of Leningrad (better known as Petrograd, formerly St. Petersburg) contains immense green columns of pure malachite obtained from Siberia. Large quantities of this mineral are also found in the copper fields of Katanga in the Congo, and also in Australia.

The most important copper minerals are the sulphides. Pure copper sulphide, or copper glance, is an important constituent of the ores of Spain and of Butte, Montana. More common are the complex sulphides, notably copper pyrites, a mixture of copper and iron sulphides possessing a brass-like colour and containing nearly 35 per cent. copper. This mineral occurs widely and provides the bulk of the copper produced in the world.

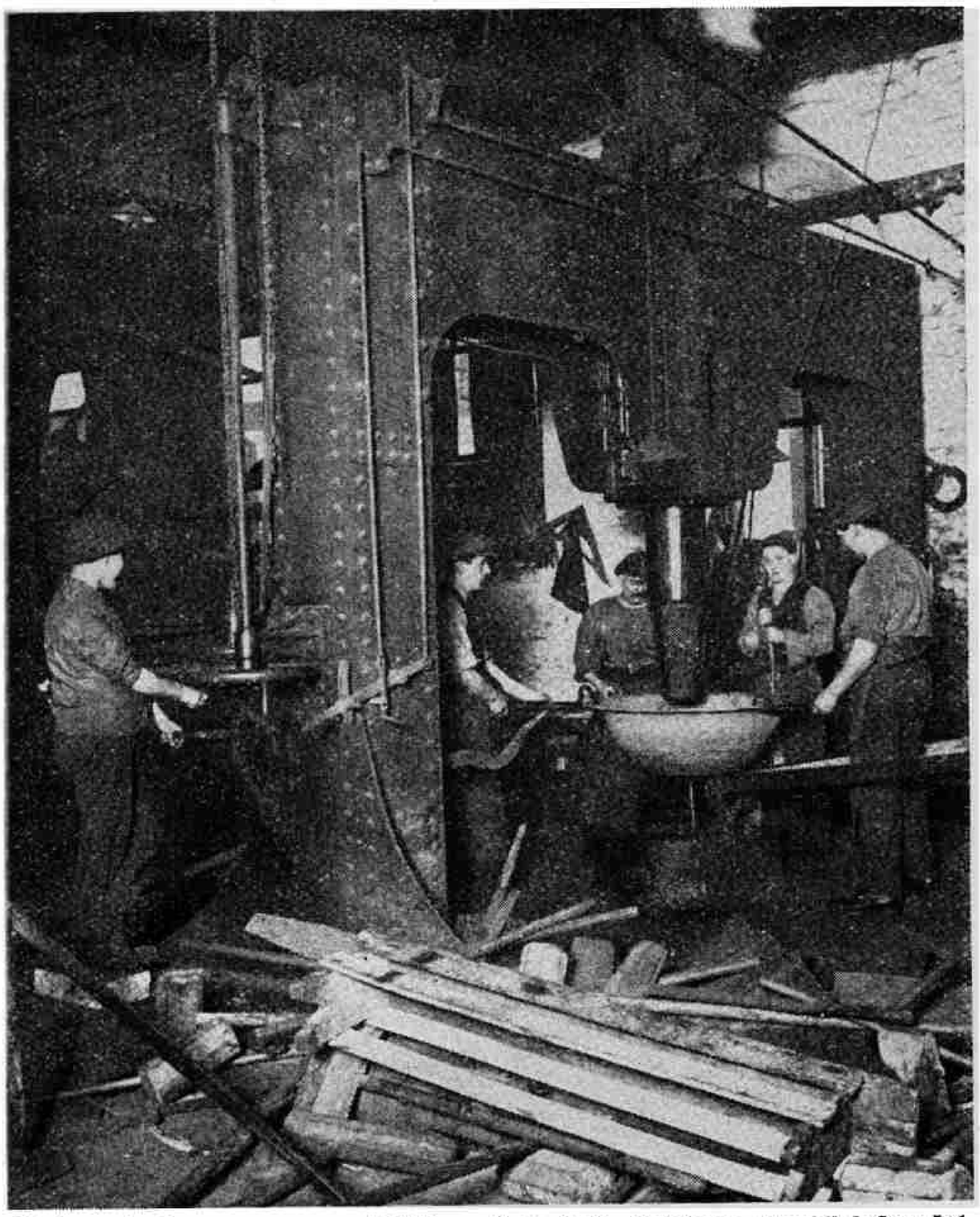


Photo courtesy [*Williams, Foster & Co. and Pascoe, Grenfell & Sons Ltd.*

Steam-hammer Beating Copper Bowl from the solid

Industrial Uses

The industrial uses of copper are more varied and more extensive than is generally recognised. Everybody knows that enormous quantities of copper are used in the form of wire—from the thinnest "flex" to the stoutest cable—for conducting electric currents, but the extent to which the metal is used in other directions is by no means fully appreciated.

Take, for instance, the locomotive. Throughout the British Empire and most parts of the world copper is used almost exclusively for the plates of which the firebox is constructed. Steel is more commonly used in the United States and in Canada, but copper, in spite of its greater cost, has many points of superiority over steel. Its high conductivity for heat results in greater efficiency for a given fuel consumption, it scales much less quickly than steel and it is less liable to failure during use. The strength and hardness of copper used for firebox plates is increased by the addition to it of a very small quantity of arsenic.

Locomotive boiler tubes may be made of copper, brass, or steel. New copper tubes give a service equal to approximately 110,000 miles as compared with a service of 70,000 to 80,000 miles for mild steel. Vast quantities of copper and its alloys are used also for similar purposes in the engines of ships of all types.

In many industries such as brewing, distilling and jam-making, the metal vessels employed must be able to withstand the action of various acids. On account of its high resistance to corrosion, copper is very extensively used for making the

(*Continued on page* 95)

The "Flying Scotsman"

New Rolling Stock for East Coast Trains

TWO entirely new restaurant car trains have recently been completed for the famous "*Flying Scotsman*," a train that has been leaving King's Cross, London, and Waverley Station, Edinburgh, at 10 o'clock every week-day morning, since 1862. Indeed, this train holds a unique record for unaltered time of departure, for on no other railway has any single train left at any particular time of the day for such a long period as 62 years.

The new trains embody many novel features, of which perhaps the principal innovation is the exclusive use throughout the train of electricity instead of gas for cooking and lighting.

Cooking with Oil Lamps

It is interesting to compare the restaurant cars of olden days with those now running on the East Coast route to Scotland. The first restaurant car saloon to run on any railway in Great Britain was instituted between King's Cross and the North in September, 1879. This car, which did excellent service and was at that time considered to be the last word in luxury, had no heating apparatus, and was only available for first-class passengers.

Railway carriages in those days had no corridors, and travellers had to remain in the restaurant car throughout the whole journey. Accommodation was limited—only 19 passengers could be seated at any one time—and the cooking was done with coal, supplemented by oil lamps. The innovation of a restaurant car for a long journey was, however, very welcome, and seats in the car were in great demand.

Articulated Restaurant Cars

The new restaurant cars for the "*Flying Scotsman*" enable luncheon or dinner to be served to 78 persons at each sitting or approximately one quarter of the maximum number of passengers that the whole train will accommodate. Two or three sittings, therefore, will suffice to meet the requirements of almost all passengers.

A separate kitchen car is placed between the first-class and third-class restaurant carriages. These, of course, are easily reached by passengers even when the train is travelling at high speeds. Thus we have a triplet restaurant car "set" which has been built on a special principle. The three carriages are carried on four bogies only, a principle known to the engineering world as "articulated." By this arrangement the riding is improved, oscillation reduced to a minimum, the weight of the train considerably lightened, and the cost of haulage thereby lessened. The whole length of the triplet set is 151 ft., and its total weight 83 tons.

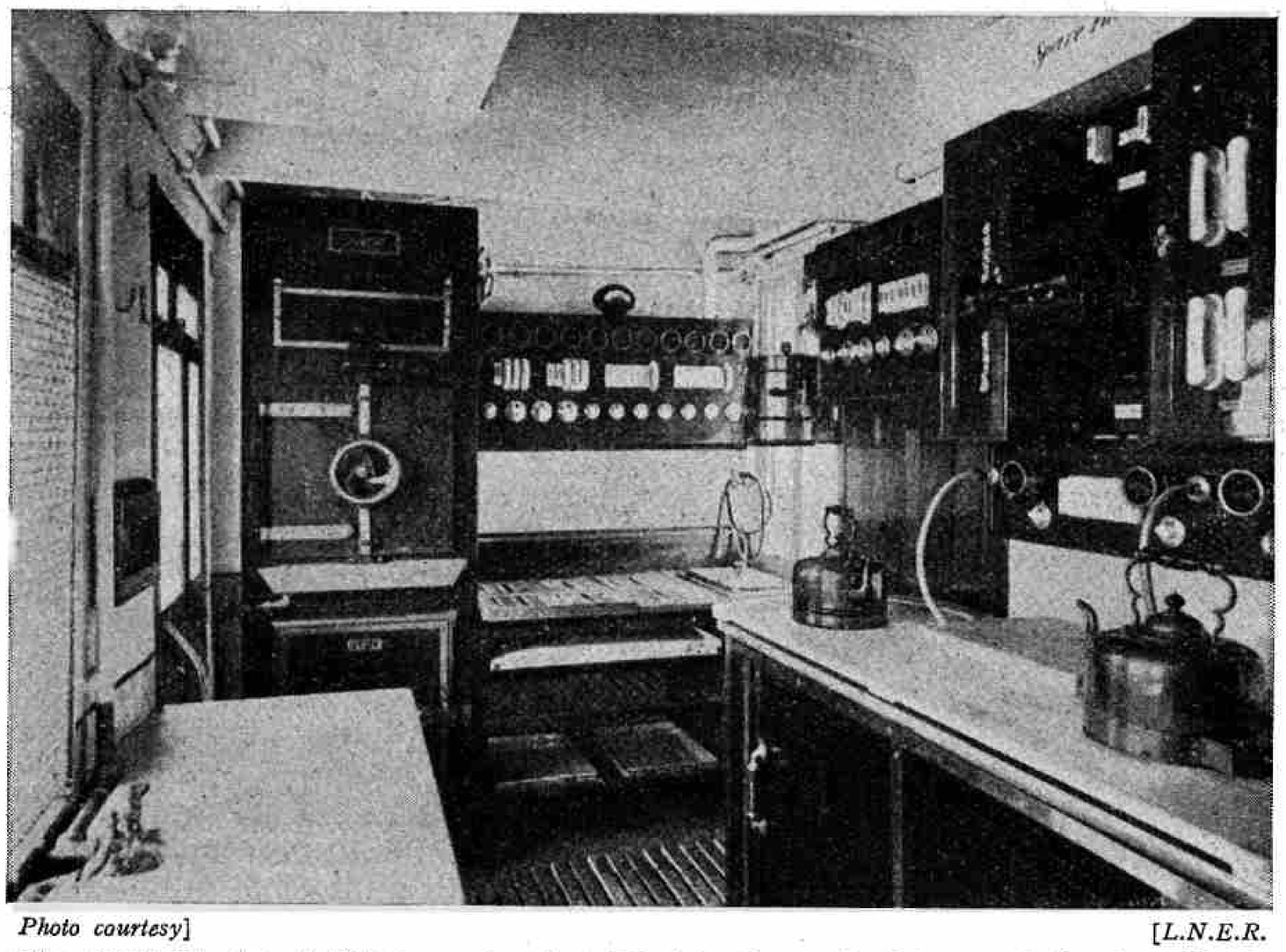


Photo courtesy] [*L.N.E.R.*

The "All-Electric" Kitchen, showing Electric Oven, Switches and Serving Hatch

The Electrical Equipment

A brief description of the cooking apparatus in the electric kitchen will no doubt be of interest in view of the novelty of the application. The credit for the introduction of the articulated train and the application of electricity throughout, is entirely due to the enterprise of Mr. H. N. Gresley, the Chief Mechanical Engineer of the L.N.E.R., under whose personal supervision the work has been carried out.

The electric current is supplied by accumulators (which are mainly used when the train is standing) and by two dynamos, carried on the under-frame of the kitchen car. The dynamos are each of 7.2 kilowatt capacity, with self-contained automatic pole changes, and are driven by means of belts from the axles of the carriage—in other words, the forward movement of the train generates the electricity which cooks the food.

The main cooking range is fitted across one end of the kitchen, and on the left is the roasting oven, with a steaming oven, grill, and hot-water tank superimposed. On the right is the boiling range, with six hot plates for frying, boiling or heating sauces, etc., and one boiling pan of 7 gallons capacity for cooking vegetables, etc. Between the serving hatches is fitted a heated cupboard which will take the whole of the plates required for the service, and the top forms a convenient table.

Two urns and two six-pint kettles are available for boiling water for teas, and for supplementing the supply from the boiler on top of the oven range. There are also two 45-gallon tanks for warm water fitted in the roof of the corridor just outside the kitchen. Electrically-heated elements are fastened on the underside of these tanks which are connected with the boiler on top of the oven range. A continuous supply of boiling water for washing-up and other purposes is thus assured, as the water is partially heated in the roof before it is brought to boiling point in the boiler.

The control of the cooking equipment in the kitchen is arranged as conveniently as possible for the chef. Pilot lamps are set over the switches, illuminating red glasses inscribed with the name of the particular pieces of apparatus in use, so that at a glance an indication is obtained of the different operations that are going on.

Simplicity of Decorations

The advantages of cooking by electricity in a railway train will be apparent to everyone, but a special point is the cooler and purer atmosphere under which the chef is able to do his work, and the fact that food cooked by electricity is better cooked and more palatable and nutritious than when cooked by any other process.

Special attention has been paid to the ventilation of the restaurant cars, by providing louvre ventilators of an improved pattern above large plate-glass windows, 4 ft. in width. Electric fans are also provided in the roof of the car for extracting the impure air from the carriage.

The tendency in recent years in the decoration of restaurant cars and other railway carriages has been to make them more and more ornate, a fact that is particularly noticeable on the railways abroad. In dealing with the scheme of decoration for the new train this tendency has been entirely reversed, however, and the prevailing note of the whole scheme

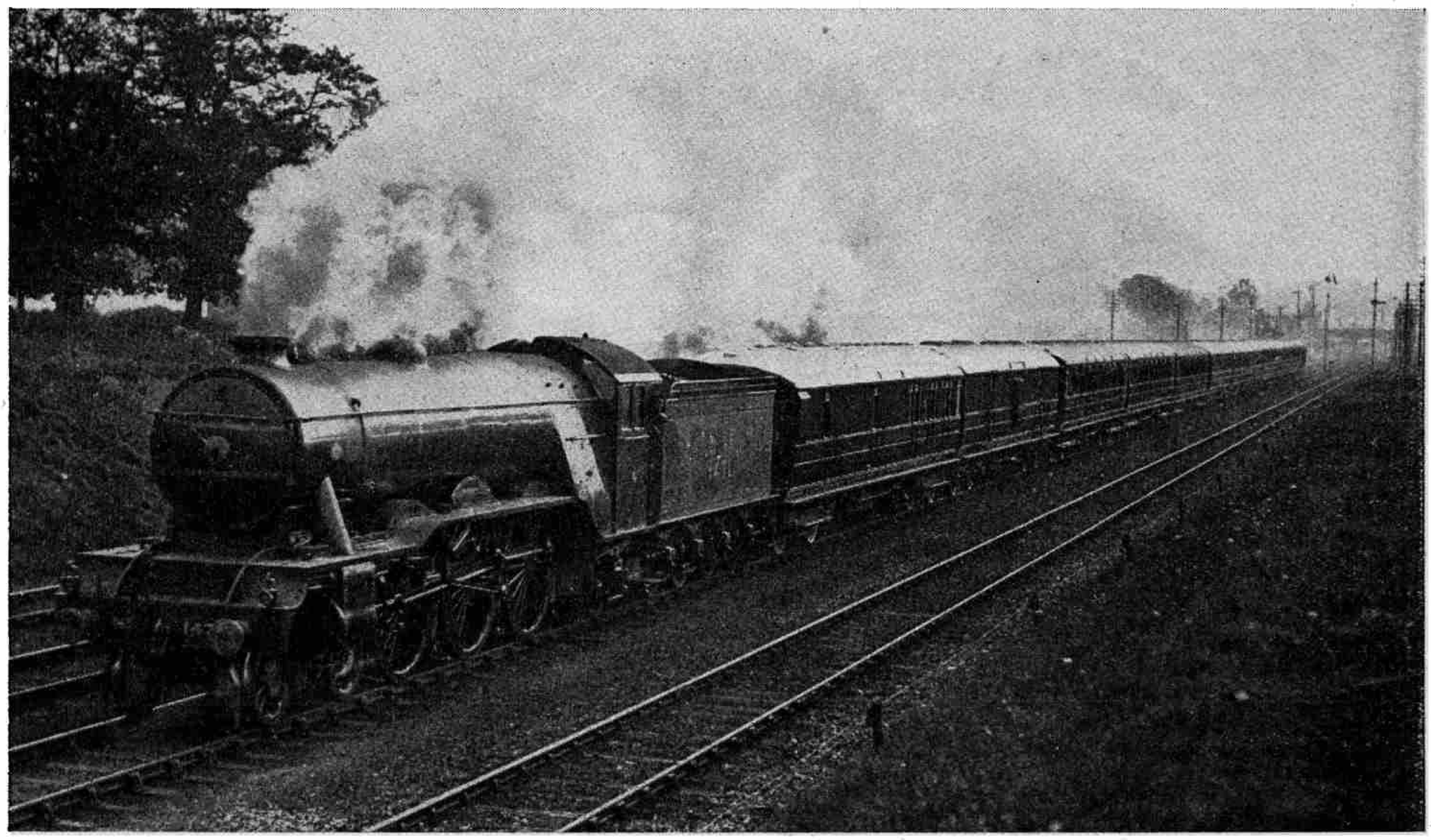


Photo courtesy] [*L.N.E.R.*

The New "*Flying Scotsman*" Travelling at Full Speed on its First Trip

of decoration throughout the train is simplicity.

The walls of the First-Class Restaurant Car are lined with large natural-coloured mahogany panels. The usual net racks and hat bags are all of the plainest possible design. The seats in the first-class compartments are of the arm-chair type, comfortably upholstered in green morocco leather and fitted with specially-constructed cushions. The floor is covered with green india-rubber over felt, which deadens sound, is very soft to walk on, and can be very easily cleaned. The lobbies are covered with cocoa-fibre mats.

The seats in the third-class compartments are very comfortably upholstered in crimson and black plush.

Throughout the compartments of the train the electric lighting is under the control of the passengers.

Automatic Coupling

Special attention has been paid to the lavatory accommodation. Hot and cold water is provided, and the floors are covered with red rubber. All the lavatories can be quickly swabbed out, the waste water running out by a special arrangement in the floor.

A special item of interest in connection with the new trains is the automatic coupling of the buck-eye type and the Pullman vestibule. The buck-eye coupling, which was first adopted by the L.N.E.R., holds the carriages rigid, and has proved its efficacy on the Sleeping Car and other trains by the East Coast route.

This is the first complete dining car train for an important service that has been constructed by the L. & N.E. Railway, and it embodies all the latest features of the best practice of each of the Companies forming the Group. The new trains are claimed to be the most comfortable and luxurious in the world for passengers paying ordinary fares, and we feel sure that every reader of the "*M.M.*" wishes he could make a long journey in one of them!

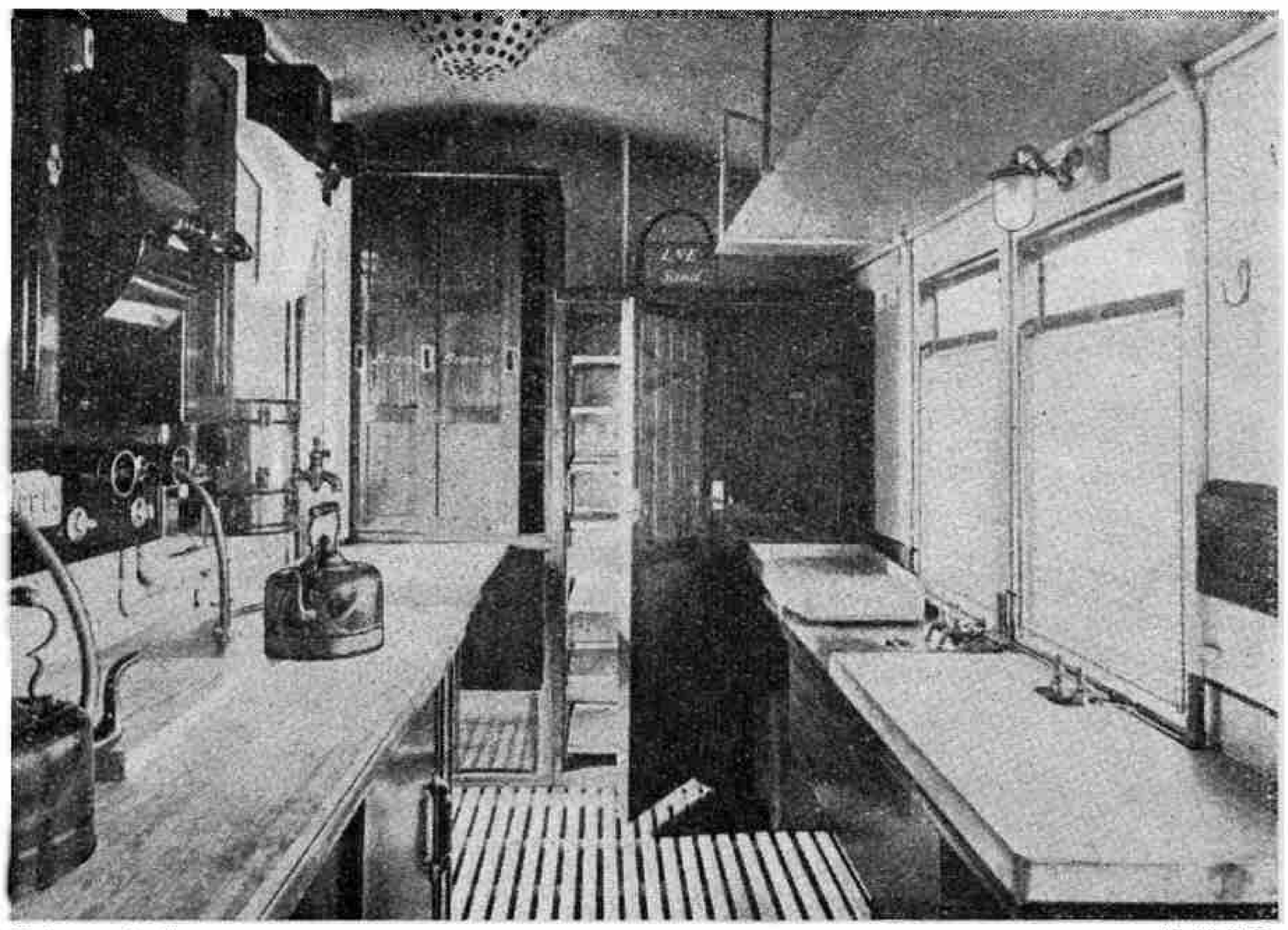


Photo courtesy] [*L.N.E.R.*

The "All-Electric" Kitchen, showing Washing-up Sink and Electric Kettles

Four of the new trains have been commissioned and all have been built at Doncaster. Each complete train includes 12 vehicles, only some of which are articulated, the others corresponding with the rolling stock of ordinary standard design but incorporating all the latest improvements.

A typical train consists of three brake vans, four composite and two third-class coaches and a "Triplet" restaurant car. The total length over-all of this train was 682 ft. and the weight 370 tons.

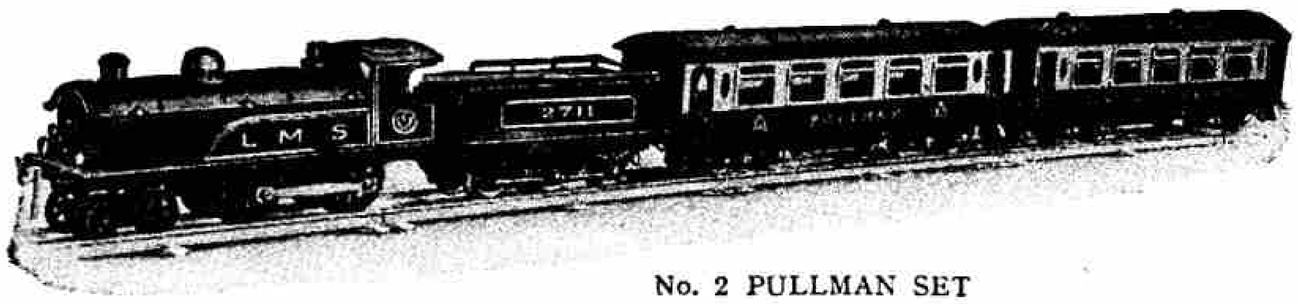
HORNBY CLOCK WORK TRAINS

THE TRAINS WITH THE GUARANTEE



YOU can have any amount of fun playing with a Hornby Train. Shunting, coupling-up the rolling stock and making up trains will give you hours of pleasure. Hornby Trains are beautifully finished, strongly made, and will last for ever. One of their most valuable features is that all the parts are standardised, and any lost or damaged part may be replaced with a new one.

Every train is guaranteed, and you are therefore sure of satisfaction if you buy a Hornby.



No. 2 PULLMAN SET

No. 2 Pullman Set

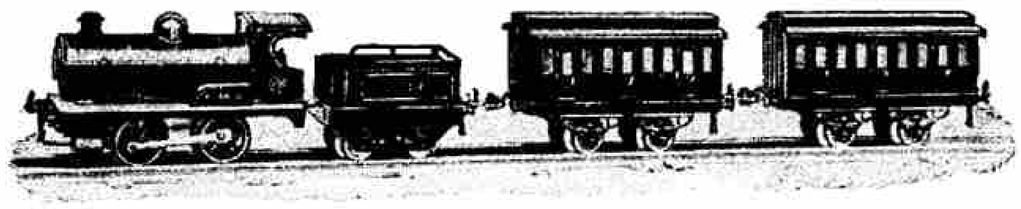
The No. 2 Loco with Tender measures 17 in. in length. The Loco is fitted with superior mechanism and the accurately-cut gears ensure smooth running. Loco, Tender and Coaches are superb in appearance and finish, enamelled in colours and stoved at a high temperature to ensure durability. The Loco is fitted with reversing gear, brake and governor.

Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling-stock. Each set contains Loco, Tender and two Coaches, with set of rails to form a circle of 4 ft. diameter. Price 60/-.

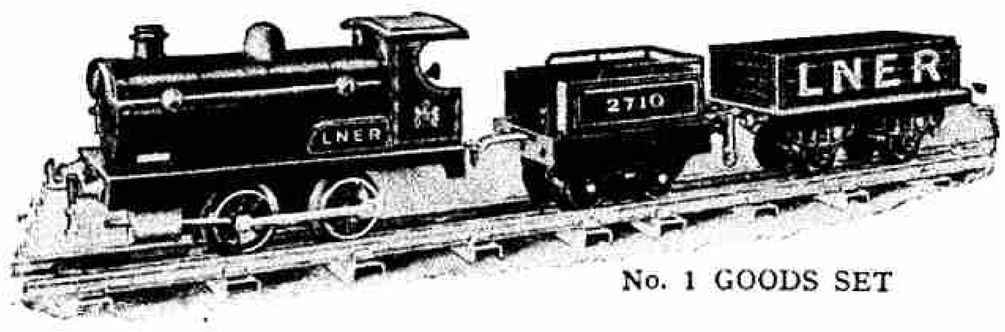
No. 1 Passenger Set

The Loco is fitted with reversing gear, brake and governor. Loco, Tender and Coaches are superb in appearance and finish, enamelled in colour and stoved at a high temperature to ensure durability. The doors of the Coaches open.

Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling-stock. Each set contains Loco, Tender, two passenger coaches and set of rails consisting of two straights and curves to form a circle of 2 ft. diameter. Price 30/-



No. 1 PASSENGER SET



No. 1 GOODS SET

No. 1 Goods Set

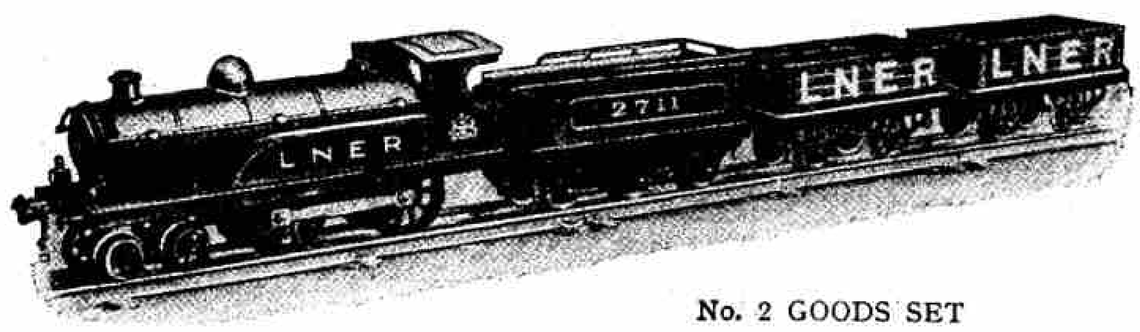
Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling-stock. Each Loco is fitted with reversing gear, brake and governor. Each set comprises Loco, Tender, one Wagon, and set of rails as in the No. 1 Passenger Set. Price 22/6

No. 1 Hornby Loco Price 15/-
" " Tender " 2/6
Hornby Passenger Coach Price 5/-
No. 1 Hornby Wagon " 2/6

No. 2 Goods Set

Gauge 0 in colours to represent the L.M.S. or L.N.E.R. Companies' rolling stock. This set contains Loco, Tender and Rails as in the No. 2 Pullman Set, and two Wagons. Loco fitted with reversing gear, brake and governor. Price 37/6

No. 2 Hornby Loco ... Price 22/6
" " Tender " 3/6
Hornby Pullman or Dining Car ... Price 15/-
No. 2 Hornby Wagon " 2/6



No. 2 GOODS SET

Ask to see Sample Sets at your Toy Store

MECCANO LTD., BINNS ROAD, LIVERPOOL



V. MORE LAYOUTS AND LOCO CLASSIFICATION

IN giving advice in regard to planning a miniature railway one is always up against the great difficulty that domestic conditions and circumstances vary so much. In the absence of detailed information as to individual requirements it is impossible to give a really satisfactory answer to the question : " How shall I plan my Hornby Railway ? " All that can be done is to make practical suggestions for miniature railway planning in general, and leave it to the unfailing ingenuity of Meccano boys to adapt these to their own needs, making whatever modifications may be necessary.

Care in Handling Rails

The comparatively few cases in which a spare room can be devoted to a permanent layout will be passed over, for the time being, consideration being given only to the Hornby Railway owners who are not so fortunate.

It is not often that an ordinary table is large enough for an interesting layout, even using the small (one foot) radius rails. Thus, in most cases the track has to be laid on the floor and taken up each time after use. In laying and re-laying the track on the floor it is necessary to use a reasonable amount of care in handling the rails, and particularly the points and crossings, so that they shall not become bent out of shape, thus causing derailments and accidents of all kinds. Incidentally, it may be remarked that the rails will remain in good condition much longer if they are packed away neatly each time according to some plan, and not simply crammed into a box in a confused mass.

Long Oval Layout

After geometrical layouts (such as those described in the November " *M.M.*") have been tried, most railway enthusiasts begin to wish to experiment on something rather more realistic. Here almost everything depends upon the size and shape of the room, but generally speaking a long oval is the best plan from which to commence operations. In order to economise space the oval should be made as large as possible, and the various sidings, etc., planned to come inside it. Fig. 1 shows the kind of simple layout that may be developed in this way. Here we have a station with a loop line and, leading off from the main line, sidings for passenger coaches and goods wagons. One of the sidings terminates in a turntable. If sufficient space is available to allow the sidings to branch off from the main line close to the station, so much the better, but it will be found that this necessitates more room.

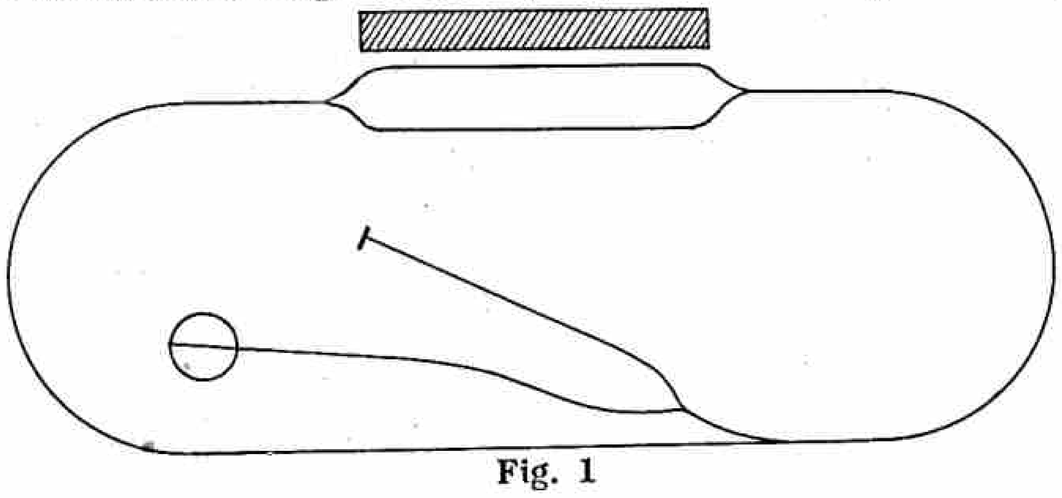


Fig. 1

With two locos hauling respectively a passenger train and a goods train a great deal of fun may be had with this layout. Two brake rails should be fitted in such a position that a train may be stopped in the station or on the loop line, and two other brake rails are required for the sidings. The exact position of these brake rails must be found by experiment.

According to the space available the plan may be developed almost indefinitely. Branch lines and more sidings may be added, but it will be found that a too elaborate system of sidings is very troublesome to work, and unless planned with the greatest care, is impracticable.

Non-Continuous Layouts

Continuous layouts are best suited to steam locos, but for clockwork locos non-continuous plans such as that in Fig. 2 are better. The greatest fun with these layouts is obtained by working out a time-table and running a number of trains in strict accordance with it. The distance between the two terminal stations will, of course, be determined very largely by the size and shape of the room, but in any case it should be adjusted according to the length of run of the locos on one winding. Nothing is more aggravating than to see a loco slow up and come to a standstill with its train half way round the track. The only way to avoid this is to make the distance between the terminals such that the locos will traverse it once, twice, or more times on one winding, with a margin to spare sufficient to allow trains to be shunted out of the way on to the loop line if required.

If the two stations are placed close together they may be attended to quite well by one operator, but more fun is obtained with two operators working stations placed as far apart as possible. If each operator has a copy of the pre-arranged time-table and follows it closely, many hours of real fun may be had, not to mention a good deal of excitement when one operator or the other makes a mistake in despatching a train. The layout shown in Fig. 2 may, of course, be developed by the addition of sidings and one or more branch lines.

(*Continued on page* 81)

New Rolling Stock and Accessories

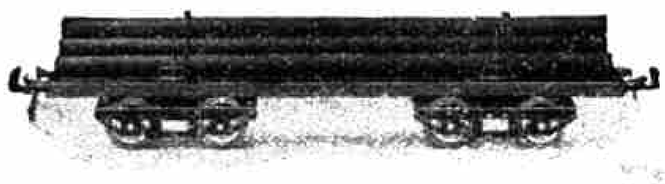
(HORNBY SERIES)

There are now 50 different train accessories—Stations, Signal-boxes, Lamps, Wagons, Level-Crossings, Foot-Bridges, Turntables, etc. Further accessories will be added to the system from time to time, and will be announced in the pages of the "*M.M.*"

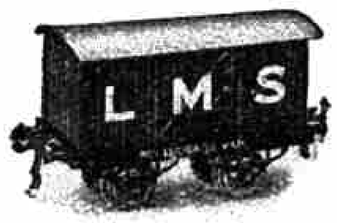
All Hornby Rolling Stock and Accessories are built in correct proportion to the size, gauge, method of coupling, etc., of the Hornby Trains and all have the uniformly beautiful finish that is the great feature of the Hornby series. With these accessories you can build up a most realistic railway system, and the splendid range of rails, points, and crossings make possible endless variety in rail layout. Hornby Trains are British made, and your dealer will be able to show you specimens of the new products.



SIDE TIPPING WAGON
Excellent design and finish.
Price **3/6**



No. 2 LUMBER WAGON
Fitted with bolsters and stanchions for log transport. Suitable for 2 ft. radius rails only. Price **5/-**



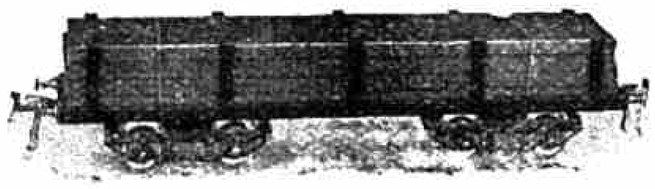
No. 1 LUGGAGE VAN
Representative colours.
Price **4/-**



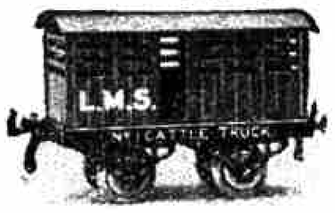
No. 2 LUGGAGE VAN
Finished in colour. Fitted with double doors. Suitable for 2 ft. radius rails only. Price **6/6**



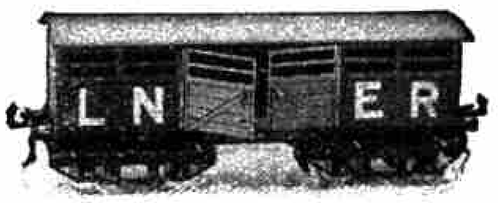
SECCOTINE VAN
Price **4/-**



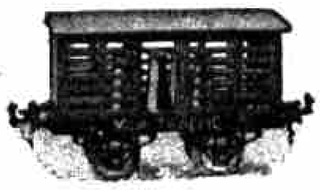
No. 2 TIMBER WAGON
Beautifully enamelled in colour and stoved. Suitable for 2 ft. radius rails only. Price **4/6**



No. 1 CATTLE TRUCK
Fitted with sliding door.
Very realistic design.
Price **4/-**



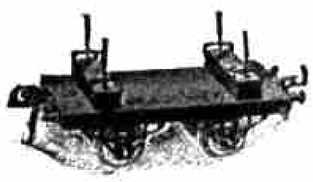
No. 2 CATTLE TRUCK
Splendid model fitted with double doors. Suitable for 2 ft. radius rails only. Price **6/6**



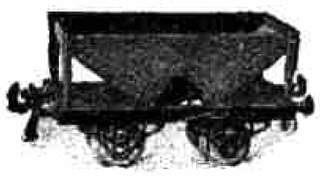
MILK TRAFFIC VAN
Fitted with sliding door, complete with milk cans. Price **4/6**



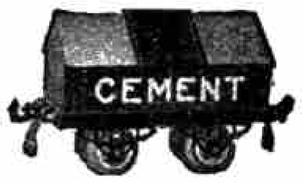
ROTARY TIPPING WAGON
Finished in colour.
Price **4/**



No. 1 LUMBER WAGON
Fitted with bolsters and stanchions for log transport. Price **2/-**



HOPPER WAGON
Mechanically unloaded.
Finished in colour. Price **4/-**



CEMENT WAGON
Finished in colour.
Price **4/-**



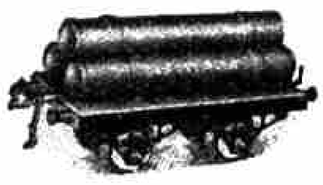
GUNPOWDER VAN
Finished in red.
Price **4/-**



BISCUIT VAN
Price **4/-**



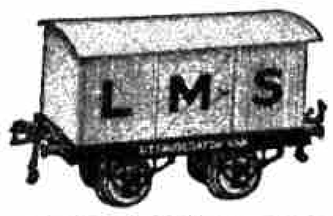
No. 1 TIMBER WAGON
Beautifully enamelled in colour and stoved. Price **2/-**



GAS CYLINDER WAGON
Finished in red, lettered gold.
Price **3/-**



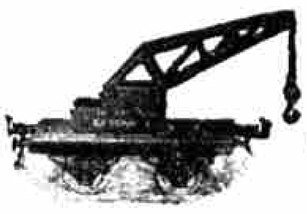
PETROL TANK WAGON
Finished in colour.
Price **3/-**



REFRIGERATOR VAN
Enamelled in white, lettered black. Price **4/-**



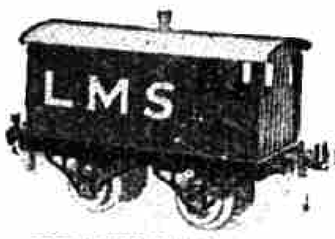
SNOW PLOUGH
Finished in grey, with revolving cutter driven from front axle.
Price **5/6**



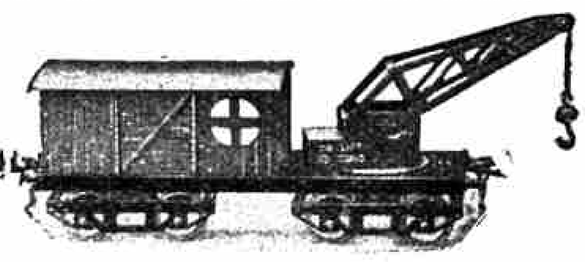
CRANE TRUCK
Working model.
Finished in colours.
Price **4/6**



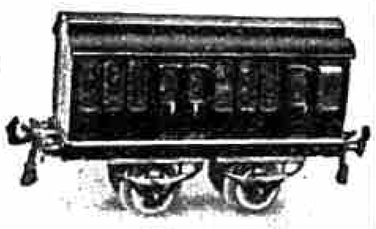
TROLLEY WAGON. Finished in colour. Suitable for 2 ft. radius rails only. Price **6/-**



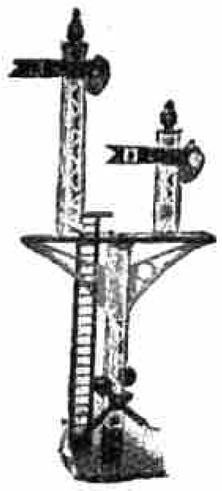
BRAKE VAN
Finished in colour.
Price **4/-**



BREAKDOWN VAN AND CRANE
Excellent finish. Beautifully coloured. Suitable for 2 ft. radius rails only. Price **7/-**



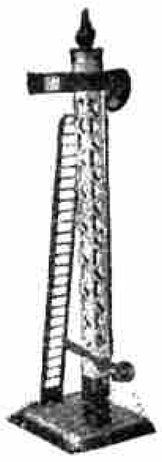
GUARD'S VAN
Price **5/-**



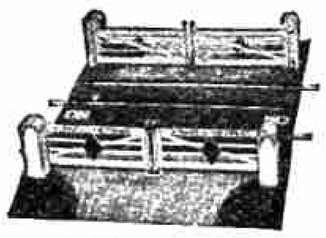
JUNCTION SIGNAL
Signal arms operated by levers at base. Very realistic model standing 14 in. in height. Price **5/6**



SIGNAL CABIN
Dimensions: height 6½ in., width 3½ in., length 6½ in. Finished in colour and lettered "Windsor." Roof and back open to allow signal-levers to be fitted inside cabin if desired. Price **6/6**



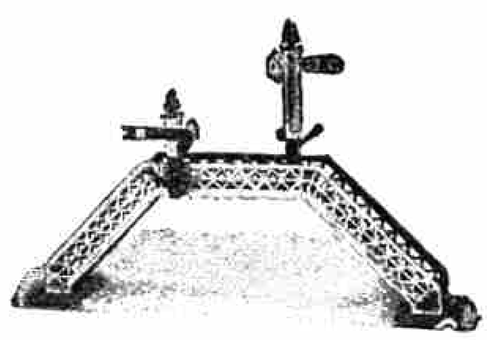
SIGNAL
Price **2/6**



LEVEL CROSSING
Beautifully designed in colour. Measures 11½ in. ×7½ in., with Gauge 0 Rails in position.
Price **6/6**



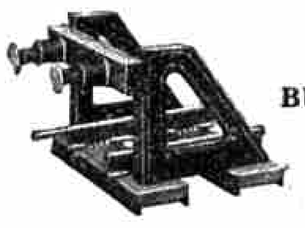
TUNNEL
Price **7/6**



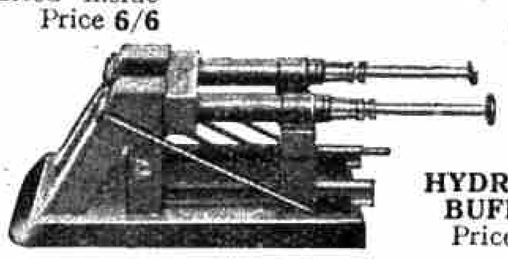
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Miniature Railways

(*Continued from page 79*)

Layouts on Landings

In a very small room, the terminal stations often cannot be placed far enough apart to give a satisfactory length of run between them, and in such cases the layout in Fig. 3 is useful. Here the terminal stations are both outside the oval, and a train starting from either of them may be sent round the continuous line as many times as desired, and then run into the other terminus. This layout, developed to the limits of space available, is one of th best for a small room. In order to obtain the best results two operators are needed, but if necessary one operator can manage fairly well. In this and the previous layout brake rails must be inserted in the track to bring the trains to a standstill at the correct points.

In many quite small houses there is often a fairly long hall or landing that can be pressed into service, thus making possible a much longer run than could be obtained in one of the rooms. Sometimes the layout can be extended so as to pass into and round a bedroom, and it is quite exciting to watch the trains disappear into the room and come into view again in business-like fashion shortly afterwards. The use of a room in this way makes the return of the trains to their starting point quite a simple matter.

Outdoor Railways

In dry summer weather (when shall we get any !) the railway may be taken out of doors if a small level piece of close-cropped grass is available, or failing that a level stretch of path. Unless the conditions are particularly favourable, however, it will be found necessary to provide a foundation of planks of some kind in order that the track may be sufficiently firm to allow of safe running.

In countries where they really do get a long spell of summer an out-door railway may be made a great success. An Australian Meccano boy, for instance, has laid out a most interesting out-door line. This passes partly along gravel walks and partly over a lawn. The track is laid down on thin planks supported on a light wooden trestle framework about 3 ft. high. The line winds its way round various shrubs and bushes and passes through two tunnels—one of them 6 ft. in length—and over a miniature lake by means of a realistic trestle bridge. This boy finds that he can safely leave his track down for quite a long period in the dry hot weather, but in this country, unfortunately, this appears to be impossible without the rails becoming very rusty.

If a room with French windows opening on to a lawn is available a combined indoor and outdoor line may be arranged, the terminal stations being inside the room and the track passing through the open windows on to the lawn, sweeping round a circle and finally returning to the room again. A big layout of this kind worked by two or three operators is quite an exciting affair.

The Classification of Locos

The letters I receive day by day from boys all over the world regarding their Hornby railways contain a great variety of questions on various railway matters. Beginners appear to have some difficulty in regard to the classification of locomotives according to the number and arrangement of their wheels. The modern method of representing the classification by a system of numbers is really very easy to understand. For this method the normal arrangement of wheels in every loco is assumed to be :— first, leading wheels ; second, driving wheels; and third, trailing wheels. The wheels of the tender are left out of consideration.

For example, take a loco having four leading wheels, four coupled driving wheels and two trailing wheels. Such a loco would be described as being of 4–4–2 type, and it will be seen that the figures indicate quite clearly the wheel arrangement. If a loco has either no leading wheels or no trailing wheels, a cipher, " 0," is used instead of a figure. The Hornby No. 2 Loco is an example of the 4–4–0 type, that is to say it has four leading wheels and four driving wheels, but no trailing wheels. Stephenson's " Rocket," the winner of the famous Rainhill competition, was a 0–2–2 loco, being without leading wheels and having only two driving wheels and two trailing wheels.

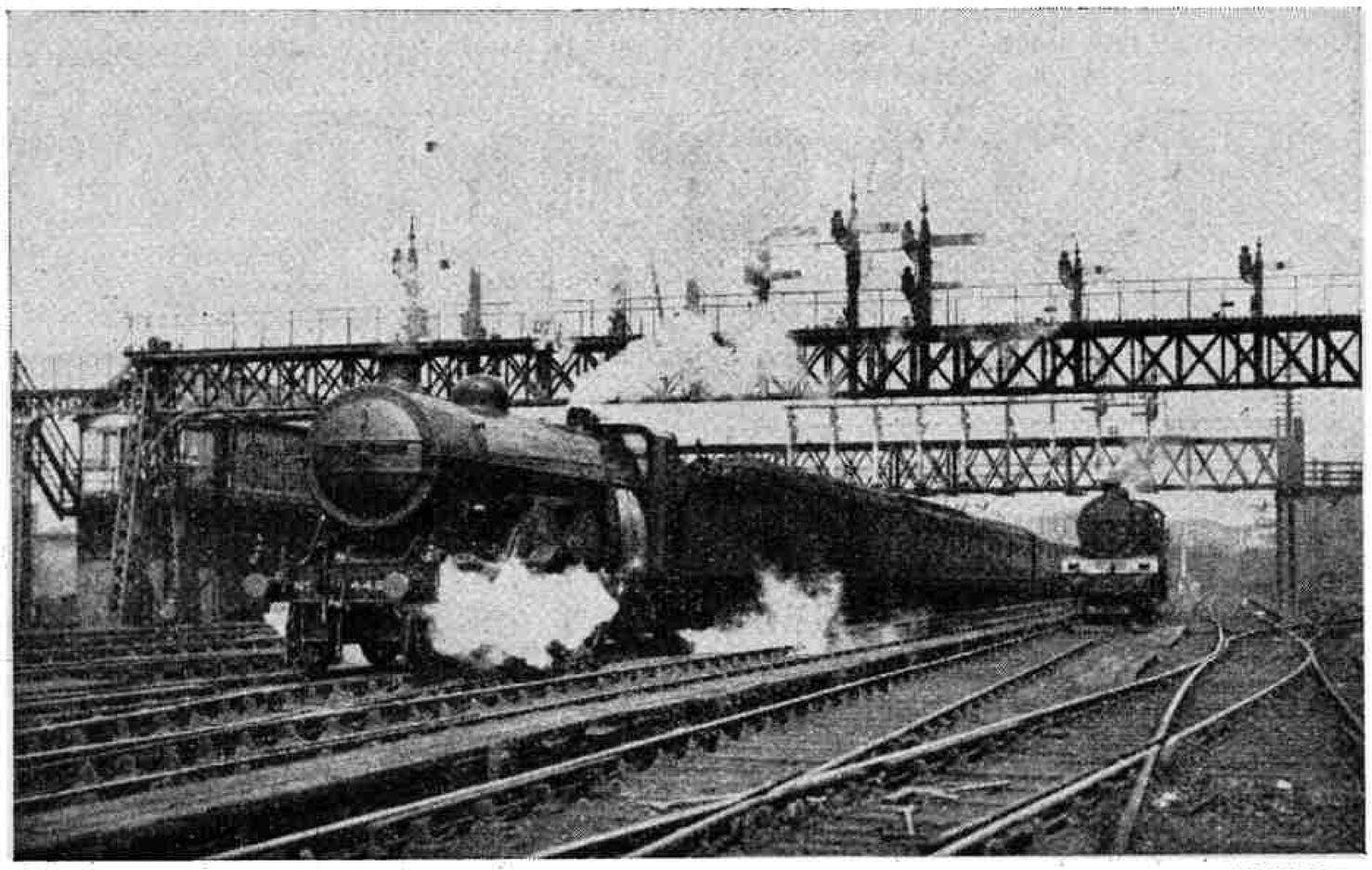


Photo courtesy] [*L.N.E.R.*

Aberdeen-London Express

Some Named Types

Certain types of locos are known by special names, most of which originated in America. Among these are " Atlantic," 4–4–2 ; " Pacific," 4–6–2 ; " Consolidation," 2–8–0 ; " Prairie," 2–6–0, and so on. Tank locos are distinguished from locos having tenders by placing the letter " T " under the figures, as for example $\frac{4\text{–}4\text{–}0}{T}$, or $\frac{2\text{–}4\text{–}2.}{T}$ The Hornby No. 2 Tank Loco is of $\frac{4\text{–}4\text{–}4}{T}$ type.

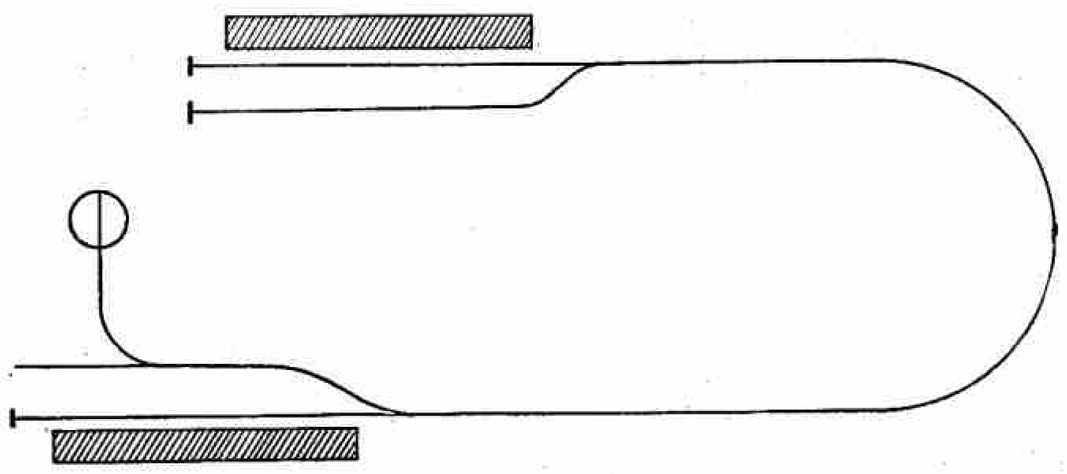


Fig. 2

Why Wheels are Coupled

Locos are also classified as passenger, goods, or shunting engines according to the work they are intended to perform. Roughly speaking, passenger locos are designed for speed and goods locos for power. One of the simplest types of loco is the " single-driver," now looked upon as out of date. In this type there are no coupled wheels, but instead there is one very large driving wheel, not connected with the other wheels, which are a good deal smaller.

The reason for the passing of the " single-driver " is that modern loco designers have established the principle that as many wheels as possible must be coupled together in order to achieve the best results. The effect of coupling wheels together is to distribute the driving force among the wheels, which increases the adhesion to the rails and gives greater stability. For this reason locos with a great number of wheels coupled together are used for hauling heavy goods trains. Tank locos, intended primarily for short-distance runs, are suitable for all kinds of work, passenger traffic, goods traffic or shunting.

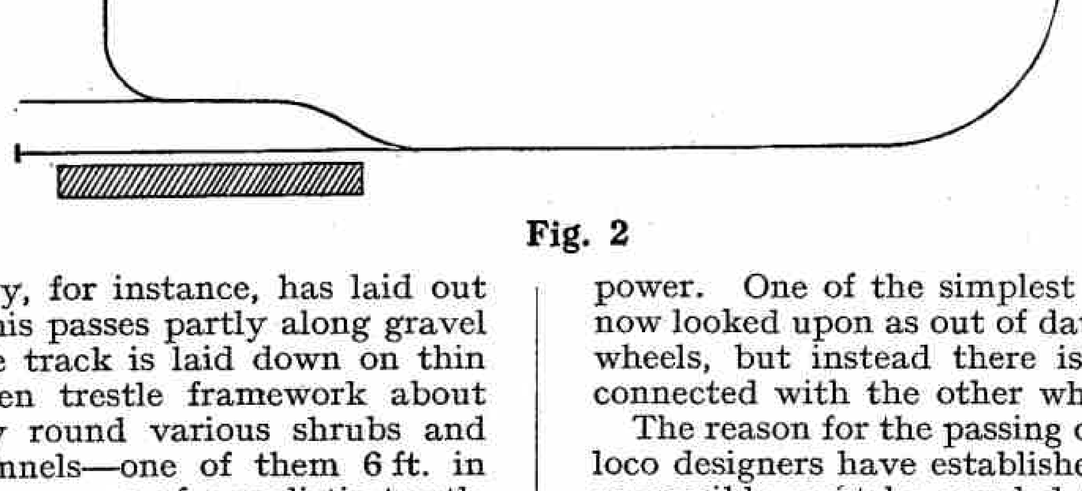


Fig. 3

American and Canadian Locos

Some young railway enthusiasts are a little worried about the American and Canadian locos on account of their strange appearance, and imagine that these locos must be constructed on very different princples from ours. As a matter of fact, however, these locos are similar in all essentials to British locos. Their peculiar appearance to British eyes lies mainly in the fact that

(*Continued on page 92*)



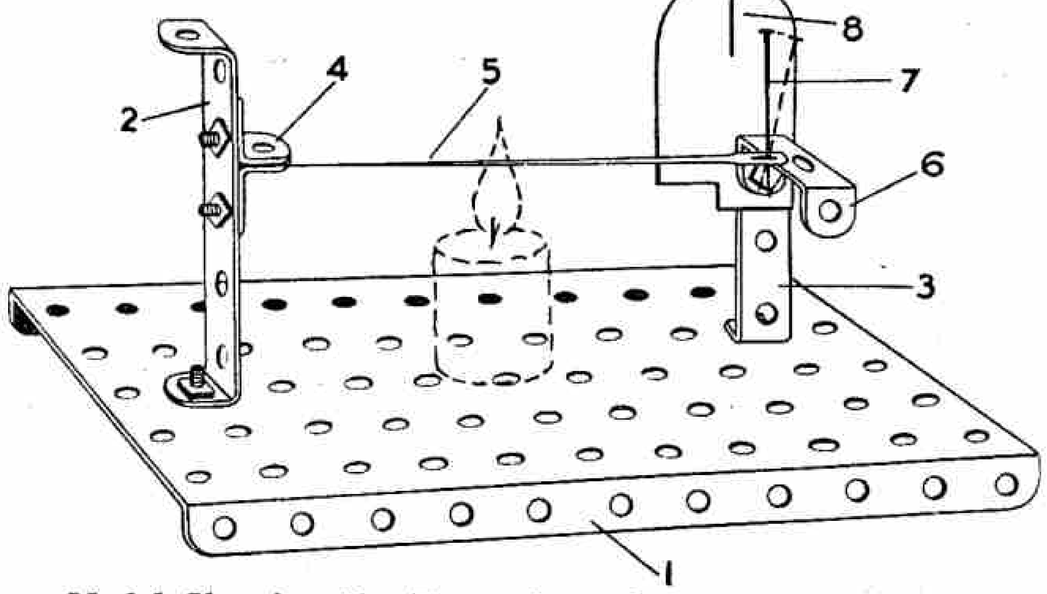
FROM OUR READERS

This page is reserved for articles from our readers. Contributions not exceeding 500 words in length are invited on any subject of general interest. These should be written neatly on one side of the paper only, and they may be accompanied by photographs or sketches for use as illustrations. Articles that are published will be paid for at our usual rates. Statements contained in articles submitted for this page are accepted as being sent in good faith, but the Editor takes no responsibility for their accuracy.

To Show how Metals Expand when Heated

Everybody knows that metals expand with heat and contract with cold, and that that is the reason why railway rails are laid with a small space between each so that they can "stretch," as it were, without forcing one another out of position. The little model shown in the accompanying photograph illustrates in a simple and interesting way this expansion and contraction.

The base of the model consists of a Flanged Plate (1) carrying two upright $2\frac{1}{2}'' \times \frac{1}{2}''$ Double Angle Strips (2 and 3). Two Angle Brackets (4) hold a large needle (5)—such as an ordinary darning needle—firmly by its point, and so placed that its eye rests lightly on the Double Bracket (6) as shown. A pin (7) is now fixed with its point in the eye of the needle, not firmly but just so that it will stand upright, with its point resting against the edge of the Double Bracket (6). A small piece of lighted candle is then placed beneath the needle and left until the latter becomes quite hot. If the head of the pin is closely watched it will be seen to move gradually as the needle expands. A piece of cardboard (8) may be cut in the shape illustrated and bolted to the Double Angle Strip (3) so that the movement of the pin can be more clearly followed.



Model Showing the Expansion of Metals when Heated

J. H. CONSTABLE (Brighton).

Photography and Meccano

Those fortunate Meccano boys who possess a camera will find it of very great value in connection with their hobby. A camera is particularly useful in regard to competitions, for it eliminates the tedious process of sketching models and it reproduces faithfully minor details which are very difficult to draw effectively. Photography is also of great use in connection with Meccano Clubs, in regard to producing permanent records of outstanding events. What, for instance, could be more interesting than a sort of photographic diary of the many happy incidents which occur during club days—picnics, football and cricket matches or model exhibitions?

T. J. ROBERTS, Liverpool.

The Wonders of Liquid Air

Most readers of the "*M.M.*" have heard of liquid air, but probably very few of them have ever seen it. At our school one day we had a lesson on this remarkable substance, and shortly afterwards our Science Master took us to a mine rescue station, not far away, where liquid air is prepared for use by rescuers after an explosion in a mine. The value of liquid air for this purpose lies in the fact that it contains about sixty per cent. of oxygen.

On arriving at the station we were taken to the room where the air is liquefied, and there we found the machine already started for use. After it had been working for a short time the demonstrator disconnected a piece of tubing, whereupon the air could be seen before it had reached the point of liquefaction. It appeared just like steam issuing from the safety valve of a locomotive. When this "steam" came in contact with my hand it felt something like being stroked with icy-cold velvet. We were all watching this "steam" with keen interest when, without any warning, the demonstrator took off my hat and held it under the jet. When he returned it to me it looked and felt as though it were wet through. Then it turned white and at the same time became as stiff as a board. Afterwards another change took place, and what appeared to be dense white smoke rose from all parts of it, as though the hat were on fire.

Various experiments were then performed with the liquefied air. A small quantity was poured into a beaker, and a piece of rubber tubing was held in it for a few moments. The demonstrator then took out the tubing and struck it sharply, when it broke into splinters. The intense cold of the liquid air had completely frozen the rubber. This experiment was then repeated with a piece of paper. Finally a test-tube was half filled with mercury and placed in the liquid air for five minutes, at the end of which period the mercury was frozen into a solid mass. The test-tube was then broken to remove the mercury, and for the first time in our lives we saw a man pick up a piece of mercury without any trouble and then use it as a hammer to drive a nail into a piece of wood!

We were next taken to see the fire engine, a 55-60 h.p. Leyland. We were also shown a gas mask specially designed at that station and approved by the Government. In full working order it weighs 38 lbs. but it is so well balanced that anyone who tried it on would be surprised at that statement.

We concluded an interesting visit by calling upon the canaries used by rescuers in mine disasters for detecting the presence of gas.

B. HUTCHINSON (Chesterfield).

Useful Copying Apparatus for Meccano Clubs

One of the most useful possessions that a Meccano Club can have is a copying apparatus, by means of which announcements and notices of various kinds may be quickly duplicated.

A simple yet effective form of duplicator may be made with very little difficulty. The materials required are a shallow tray of suitable size, such as the lid of a square biscuit tin; two ounces of good glue; eight ounces of glycerine; and a few drops of oil of cloves. Melt the glue in a small quantity of hot water, the best method of doing this being to place the glue and water in a tin standing in a pan of hot water. When the glue is melted, add the glycerine and oil of cloves and mix the whole together very thoroughly. Then pour the hot mixture into the tray and allow it to set.

To use the apparatus, the original copy of the notes to be duplicated must be written with hectograph or other special aniline ink. It is possible to make such ink but it is very much better to buy it, and it is not expensive or difficult to obtain. When the ink is dry, press the paper on the surface of the mixture in the tray and rub it gently into contact. Leave it for three or four minutes and then peel it off. An impression of the ink will now remain on the jelly, on to which blank sheets of paper are gently pressed and peeled off at once, when each one will be found to be a good copy of the original.

On the average from 20 to 50 impressions may be obtained from one copy. When the required copies have all been taken off, the jelly surface must be washed with a sponge and it is then ready for duplicating fresh material. Occasionally the jelly should be allowed to stand overnight in a warm oven, so as to eliminate from the surface all traces of the impressions that it has carried.

H. BEDFORD (Barnsley).

No More Punctures

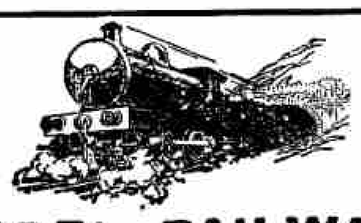


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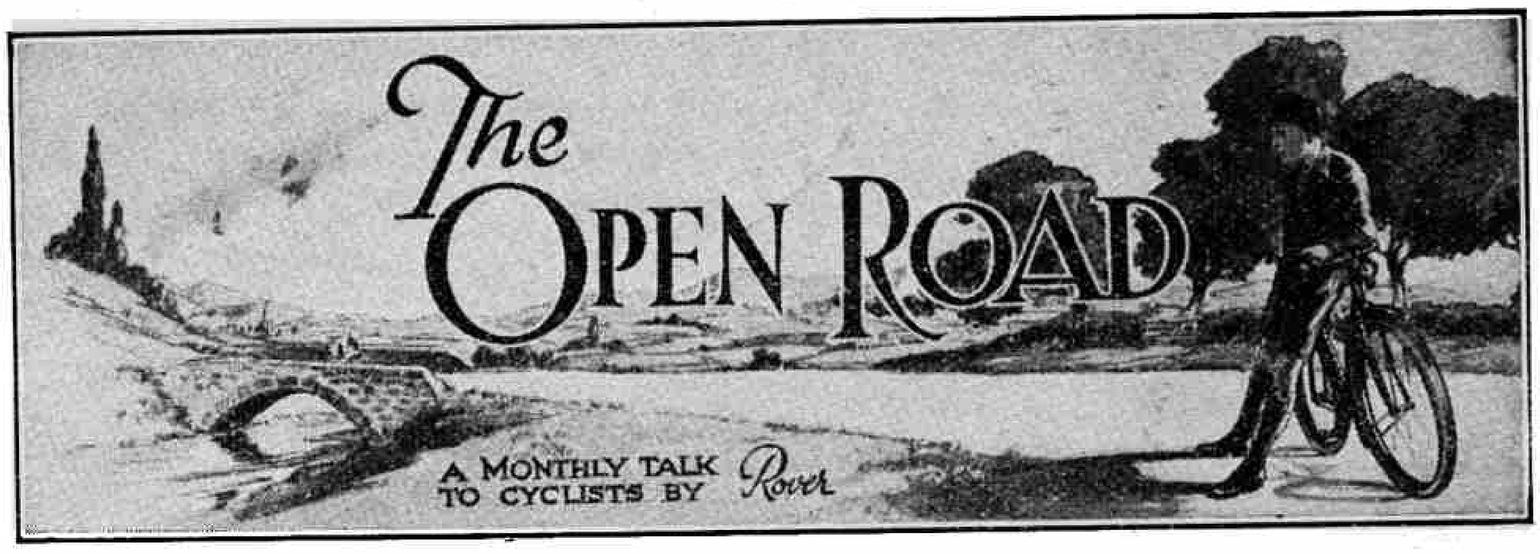
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XII. USEFUL ACCESSORIES

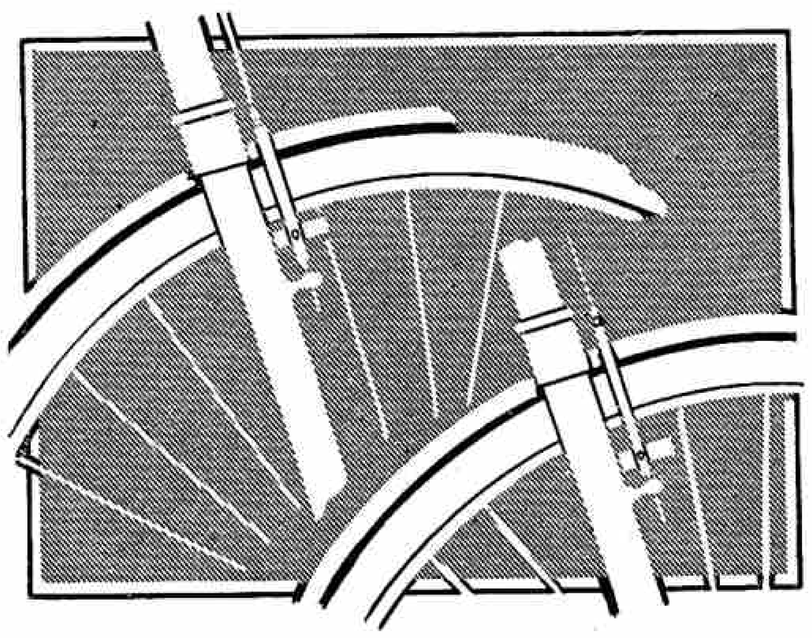
ONE of the greatest temptations to the new cyclist is that of overloading his machine with a variety of accessories. Every new cycling article on the market is eagerly purchased, from an outsize in "Felix" mascots to a wicker-work trailer, until his machine eventually resembles a perambulating shop counter. The result of this accessory-collecting habit is that the cyclist labels himself a very obvious beginner, and also makes his riding considerably more tiring. The carrying of even the most necessary accessories such as lamp, bell, and pump makes a surprising difference in long-distance touring, as every experienced rider has found. "Travel light" is advice that is particularly applicable to cyclists, and it should be remembered on every occasion when the purchase of a fascinating but obviously superfluous accessory is being contemplated.

Lamps and Bells

The two most important items in the equipment of a cycle are, of course, the lamp and the bell. In legal terms, they provide "audible and visible warning of approach," and consequently are necessary to the safety of all road-users. The subject of lamps—electric, acetylene and oil—was fully discussed in the November number of the "*M.M.*," and it is sufficient to repeat that all three have their various advantages and drawbacks, and one should be chosen to suit the rider's particular requirements.

The bell question, too, requires little comment, apart from the fact that a good one will be found to be cheapest in the long run. The tinny and ineffectual sound of a cheap model is all too familiar nowadays, and is unworthy of a good machine. A reliable bell by a well-known maker is a good investment, and with the exception of an occasional drop of oil it will require no attention. The bell itself should not be too large or ostentatious, and should be fitted to the handlebars in preference to the top tube.

BRAKE ADJUSTMENT



To be efficient, brake blocks must be fitted so as to be close to the rim, but of course not actually touching it. The two sketches show correct (upper) and incorrect (lower) positions when the brake is not in use.

Luggage Carriers

Almost all cycles on the road nowadays are fitted with a luggage carrier of one kind or other. Perhaps the most popular is the one that is fitted to the seat stays over the rear wheel. Other types are made to fit the head of the machine or for carrying on the handlebars, while special clips to hold tennis-racquets, rifles, golf-clubs, and cycling capes may be obtained from the majority of sports or cycle dealers.

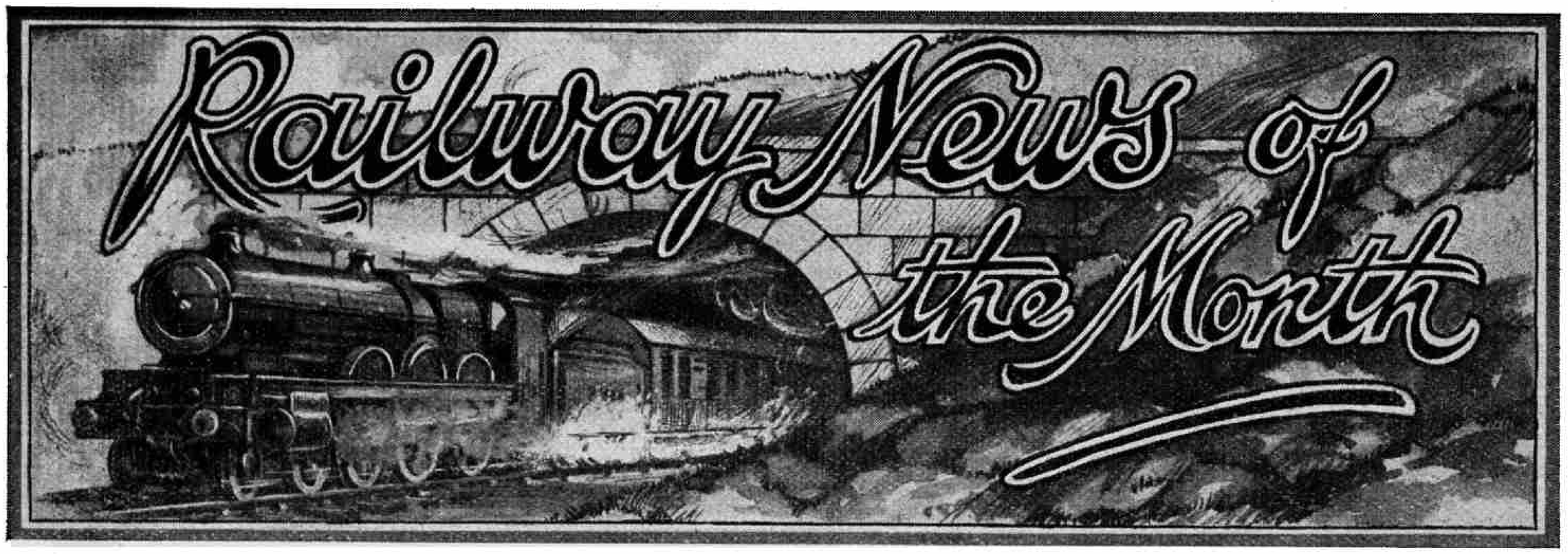
A rear-carrier has several decided advantages over other types. Any weight upon it, such as parcels or luggage, does not affect the steering as would be the case if the weight were at the front. Also, as the back wheel is the steadier of the two, there is far less jolting or vibration—often an important consideration when out shopping! Several different types of rear-carriers are obtainable, ranging from a clip-on carrier, attached by a single nut, to the light and rustless but more expensive aluminium type, and the final choice must be left to the rider's requirements and purse.

Cyclometers

Although not an essential part of a cycle, there is probably no more popular accessory than the cyclometer, and its first expense is amply repaid by the added interest and information that it affords. The instrument is fitted to the front wheel and it not only automatically records every mile covered, but it also affords useful information regarding the mileage obtained from tyres or other fittings. In purchasing a cyclometer care should be taken to see that the instrument is not of continental make, as these quickly prove unreliable and inaccurate.

One or two extra tools such as an adjustable wrench and a screwdriver must also be included in this list of useful accessories, and a couple of cleaning brushes, a stiff one for the chain and a softer one for the enamelled parts, will

(*Continued on page* 95)



Railway Progress in 1924.

At the beginning of a new year it is always instructive to look back over the previous year and note the progress made in the various branches of engineering. This is particularly the case with railway engineering, which covers such a wide field of operations. In the issue of the 9th January, "*The Engineer*" reviewed in its customary efficient and comprehensive manner the principal railway works carried out during 1924, and from this review we extract a few particulars that are likely to interest our readers.

London Midland and Scottish

On the London Midland and Scottish Railway, station improvements and extensions were commenced at Bangor and St. Annes. The two lines of railway between Chevet Junction and Snydale Junction, south of Normanton, are to be increased to four at an estimated cost of over £200,000. The first stage in this work is the opening up of Chevet Tunnel, 702 yards in length, and this is now nearing completion. Good progress was also made in the work of duplicating the two lines of way on the Lancashire and Yorkshire section between Horbury and Wakefield, which work has now been proceeding for some two years. Good progress has been made with the extensive additions to the siding accommodation at Ellesmere Port.

London and North Eastern

During the year several bridges were renewed on the Great Eastern section of the London and North Eastern Railway, chief among these being the underline bridge that carries the Cambridge main line over the River Lee between Broxbourne and Roydon. The old bridge had a central span of 60 ft. and two side spans each of 31 ft. On account of unequal settlement in one of the piers, and other defects, it was decided to renew the bridge in one span. The trusses of the reconstructed bridge have a span of 136 ft. from centre to centre of end pins, and are 20 ft. in depth between the axes of the top and bottom booms. They are of the riveted-through truss type and are sub-divided into eight 17 ft. bays. The ends of the trusses rest on steel rocker bearings, and at the Broxbourne end of the bridge provision has been made for expansion and contraction. The bridge is designed to carry a static axle load of 25 tons.

Up and down goods lines between the Ouse box and Huntingdon, including a new bridge over the River Ouse, were completed, and the Cuffley and Stevenage line was opened for passenger traffic. The latter line provides an alternative route between King's Cross and Stevenage and renders unnecessary, for the time being, the widening of the tunnels and viaduct at Welwyn. A new engine yard at King's Cross was opened, with a turntable 70-ft. in diameter. This turntable obviates the necessity for the 4–6–2 tender locos having to go to Hornsey to be turned.

A contract was let for the provision of a new steel viaduct to replace the existing timber viaduct on the Blyth and Tyne, between Bedlington and North Seaton. The new viaduct will consist of eleven spans of 75 ft. each, two of 68 ft. each, and one of 80 ft. 9 in. The timber viaduct has 43 spans of 25 ft. each. At the entrance to Tyne Dock new gates, sluices and machinery are being provided. New electrically-driven pumps are being installed at the Alexandra Dock Dry Docks, Hull, together with new dock gates for the Alexandra Dock entrance. At the electric and hydraulic power station at Immingham, the Lancashire boilers are being replaced by water-tube boilers, and additional electric generators are being installed. A beginning has been made with the reconstruction of Berwick Station, a work that will cost about £43,000.

Great Western

On the Great Western Railway the High Street Station at Swansea is being reconstructed. This is a terminal station, and its present three platform lines are to be increased to five, each to be 800 ft. in length. New carriage sidings, with a turntable of 65 ft. diameter, are being provided between Swansea and Landore. The heading of the second single line, Colwall Tunnel, was driven for 980 yards out of the total of 1,600 yards and was lined for 330 yards. The Newton Abbott junction station is to be rebuilt, and it is hoped to have a good deal of the additional platform accommodation ready for this year's summer traffic. The new station buildings at Aberystwyth are well in hand.

One of the two remaining timber viaducts built by I. K. Brunel is being replaced by a solid embankment. This is situated on the Falmouth line near the point where that branch leaves the main line at Penwithers Junction. About a quarter of a million cubic yards of filling will be required. The other Brunel viaduct is at Perran nearer Falmouth, and this is being replaced by a masonry arch structure erected alongside it.

The new ventilating plant for the Severn tunnel was brought into use during the year.

Southern

The Totton, Hythe and Fawley light railway on the Southern Railway is approaching completion. Each of the three stations will have platforms 350 ft. in length. Reinforced concrete has been mainly used for these and for the nine under and over bridges and the numerous culverts. Reconstruction of the station buildings at Southampton Town was begun, and considerable progress made with the enlarged station at Exmouth, which is to have two platforms 600 ft. in length and 25 ft. in width.

The locomotive depot at Exmouth Junction, the principal depot of the Southern Railway in the West of England, is being re-modelled. It is to have a ferro-concrete engine shed 270 ft. in length and 235 ft. in width, with thirteen roads, a mechanically-driven coaling plant, and an electrically-operated engine turntable 65 ft. in diameter. The scheme includes also a carriage and wagon shop 310 ft. by 100 ft. and shops 500 ft. by 30 ft. for the engineer's department. The machinery will all be electrically operated. A group of ten sidings to accommodate 400 wagons is being laid down.

For the electrification of the South-Eastern section, 180 miles, single track, of conductor rails were laid, and about 200 miles of the running rails bonded for the return current.

Metropolitan and Great Central Joint

On the Metropolitan and Great Central Joint Railway the alterations at Harrow, preparatory to carrying the Uxbridge branch line under the main lines, were made in October. New automatic signalling was brought into use, and this system was carried on to Rickmansworth in November. The electrified line between Harrow and Rickmansworth was opened last month. A junction is being put in under Euston Road, London, and a length of railway laid to couple up the Metropolitan main line with the Widened Lines, which start at King's Cross and run to Moorgate.

Underground

The Charing Cross line on the Underground Railway is being extended under the river to Kennington. The circular loop at Charing Cross will be done away with and one will be provided at Kennington. Many other important improvements are well on the way towards completion.

More Underground Stations

Four new stations on the Clapham-Tooting section of the Underground are to be constructed. Two will be entirely below the surface and the two others will have booking halls on the ground level.

New L.N.E.R. Rolling Stock

The L.N.E.R. is shortly to introduce new rolling stock on its suburban lines. The new trains will consist of ten coaches with a carrying capacity of 872 passengers. There will be two units, each made up of five coaches, built on the articulated system similar to that successfully adopted on the L.N.E.R. trains running between King's Cross and Edinburgh. Further details will be given in one of our future issues.

Experimental "Sentinel" Locos

The well-known makers of the "Sentinel" wagon have recently developed an entirely new type of power unit for use on railways. The new unit consists of a steam loco with vertical engine, the length over-all being 16 ft. 10 in., width 8 ft., and wheel-base 7 ft. The total weight is 17 tons. It is anticipated that these locos will be particularly useful in shunting operations. It is claimed for these locos that the adhesive factor is so much greater than that of locos of the ordinary type, that weight for weight, they are able to haul approximately a 35 per cent. greater load for about one-third of the working and maintainence costs.

Only Three Fatal Accidents

During 1924 there were only three train accidents in which passengers lost their lives. On 26th April, two passenger trains were standing at the Euston No. 4 box—a night Scotch express on the up fast line and an excursion on the up slow. The express went forward first, but the signalman sent the "train out of section" signal on the slow line instrument instead of on the one for the fast line. A second train on the up slow line was then accepted and it ran into the excursion train with the result that five passengers were killed. The second fatal accident was at Haymarket, Edinburgh, on 28th July, when a passenger train standing in the station was run into by another train and five passengers were killed. The third accident was at Warton signal box, Lytham. On 3rd November, the tire of the left-hand leading wheel of the bogie of an engine fractured, causing the derailment of the train and the loss of thirteen lives.

One Thousand Million Passengers

Railway statistics issued by the Ministry of Transport recently show that there have been substantial increases in both passengers and receipts on the railways of Great Britain during last year. During the first ten months 1,036,623,323 passenger journeys were made, this figure showing an increase of 6,735,000 over the similar period in 1923. Excursion and week-end fares also increased by 41,770,681, the total being 152,212,739. There was a slight reduction in the number of workmen's fares with a total of 258,219,638, and a falling-off of 6,765,300 in "other descriptions," which numbered 73,770,292.

An Increase of £1,400,000

The passenger receipts for the ten months were £59,348,863, an increase of £2,074,392 on the similar period of 1923. Excursion and week-end fares stood at £11,991,007, an increase of £2,936,571. Workmen's fares at £3,421,286 showed a decrease of £9,200, while the "other descriptions," totalling £7,355,425, gave an increase of £250,488. Including season ticket-holders, parcels and miscellaneous traffic, the total receipts from passenger train traffic reached £80,669,070 for the ten months—an advance of £1,477,799 on the corresponding period last year.

Falling Off in Freights

Freight train traffic showed a falling off during the ten months of 5,983,088 tons, the total being 284,517,046 tons. General merchandise at 52,424,481 tons, and minerals at 55,682,681 tons, show respective increases of 2,193,687 tons and 2,916,376 tons, but coal, coke and patent fuel, which aggregated 174,292,345 tons, is down by 10,110,839 tons. The total receipts from these sources were £89,159,473, a decrease of £3,579,703.

Successful Articulated System

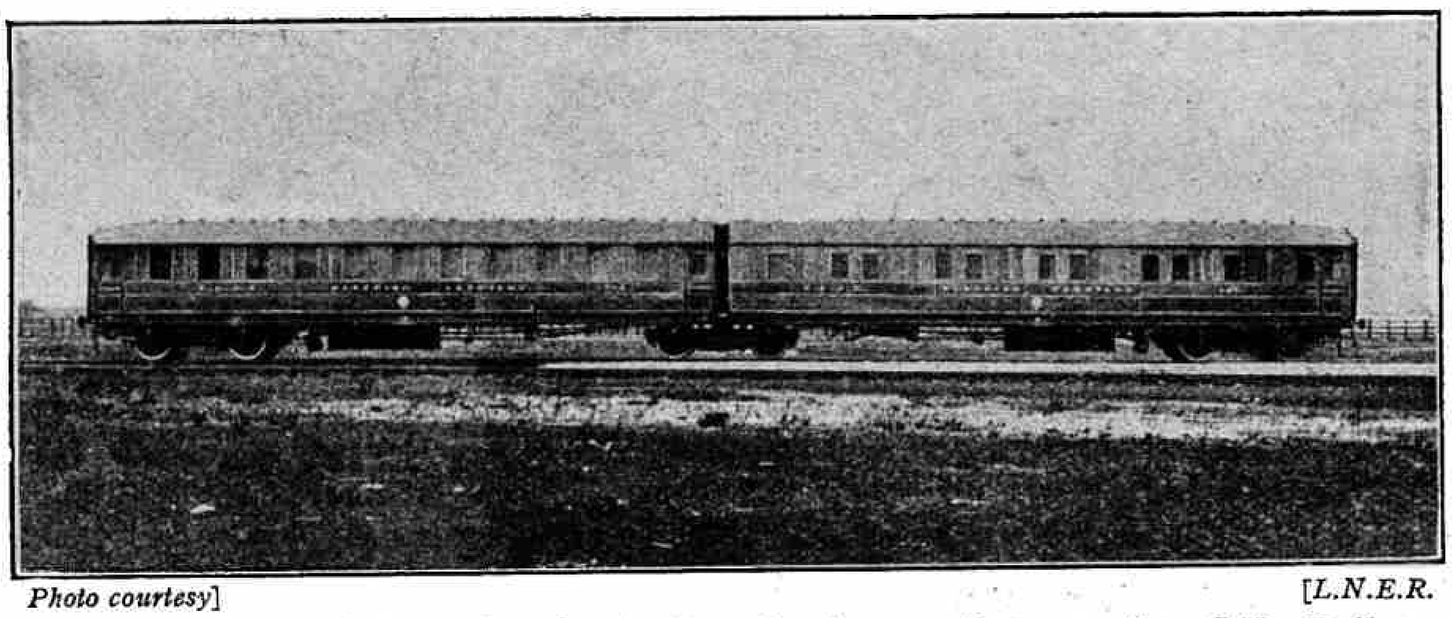


Photo courtesy] [*L.N.E.R.*

The above photograph, showing a sleeping carriage on the G.N. Railway, illustrates one of the first units to be built on the articulated system evolved by Mr. H. N. Gresley, the Chief Mechanical Engineer of the L.N.E.R.

The articulated principle was adopted in the quintuple, or five-coach, dining-car trains between King's Cross and Leeds. More recently the principle has been successfully applied to the express trains on the L.N.E.R. service between London (King's Cross) and Edinburgh (Waverley). Our illustration is of particular and topical interest because of the announcement made on this page regarding the new L.N.E.R. suburban rolling stock that is now being built on the articulated principle.

Ancient Castle Wall Discovered

While excavating in connection with the re-building of Berwick Station, the engineers of the L.N.E.R. recently discovered part of the East wall of the old Castle, upon the site of which Berwick Station stands. Particular care is being taken in reconstructing the Station to preserve the historic foundations, and it is hoped to discover further remains of the old Castle.

New Railways in Turkey

New railways are shortly to be constructed in Turkey and in Persia. In the former country three lines are contemplated, 30, 60 and 120 miles in length respectively. The longest of the three will join the railway from Baghdad to Ardassa. In Persia an American Company has obtained a concession from the Government to build a railway from Teheran to Tabriz.

Popularity of Restaurant Cars

The L.M.S. reports that during the past year 1,811,164 meals were served on its restaurant cars. The figure shows an increase of 219,384 on the total for the previous year.

Sleeping Saloons for L.M.S.

Ten new first-class sleeping saloons have recently been built at the Wolverton works of the L.M.S. for service on the London-Scotland route. Similar in arrangement to the standard sleeping cars, the new cars have an overall length of 71 ft. 8 in., a width of 9 ft., and weigh 41 tons. Each saloon contains twelve single berths, attendant's compartment, and lavatory. Special attention has been given to the springing of the cars to ensure smooth running, and each saloon is mounted on two 6-wheeled bogies and supported on an all-steel underframe. The cars are equipped with Westinghouse steam heating, and the electric lighting switches to each berth are under the control of the attendant.

Travelling Hothouses

One hundred special vans have been completed at the L.N.E.R. works at Stratford for carrying bananas from the port to the consumer. These vehicles are insulated and so arranged that the whole of the inside is air-tight. Steam heating-pipes keep the fruit at a suitable temperature.

L.N.E.R. Water Troughs

The water level in the troughs on the G.N. section of the L.N.E.R. has been raised by 1 in. to bring it to the same level as the water in the troughs on the other sections. This makes it possible for locomotives on different sections to pick up water throughout the whole system.

Just like Dad's..



PRICE
25/-
A PERFECT WORKING
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WORLD'S STANDARD
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The Amplion name-plate guarantees a genuine product of the House of Graham



Photograph courtesy of] [Messrs. Gent & Co., Ltd.

Hoisting into Position the Hands of the East Dial

Electric Clocks—(*Continued from page 57*)

pendulum. The length of the pendulum is so regulated that it takes half a minute for it to complete the fifteen swings, so that an impulse occurs once every half minute. By means of an electro-magnet it is a simple matter to make these impulses turn a ratchet wheel with 120 teeth once in an hour and to attach a minute hand to this. The hour hand is driven from this by the usual gearing.

There is no limit to the number of dials that can be worked from the one master clock, the only connection between them being two wires to carry the currents. In the Royal Liver Building at Liverpool

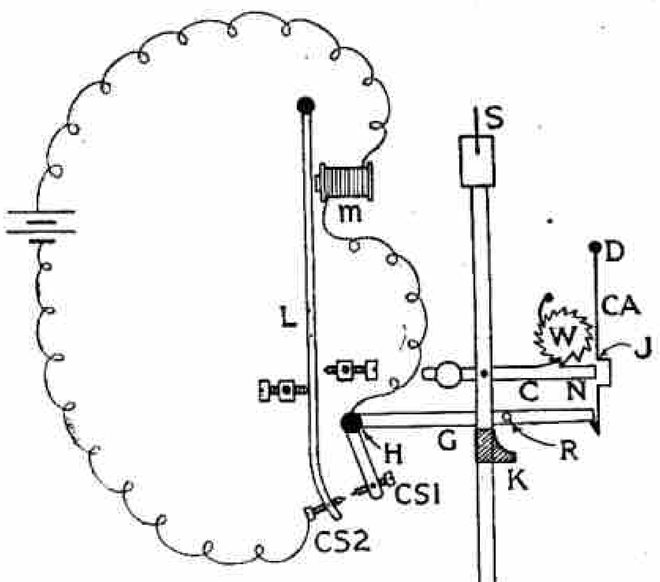


FIGURE 4.

over 600 dials are controlled by a master clock in the main hall. Controlled dials may be placed anywhere in any room in a large building, in offices, or in the factory; throughout a ship or in all parts of an exhibition, as at Wembley, or even in different parts of a town.

It is not necessary to have an electrically-driven clock to operate these dials, since a control attachment can be put on any clock that will switch a current on and off for a moment at stated intervals. In fact, the writer of this article has made an extension of the ordinary weight-driven Meccano Clock model that enables it to control any number of dials in different rooms of his house. The clock itself may stand in the hall and be made to control dials in dining and drawing rooms and in as many bedrooms as may be desired. This model will be described in a forthcoming issue, and is sure to arouse considerable interest among our readers.

A Wonderful Building

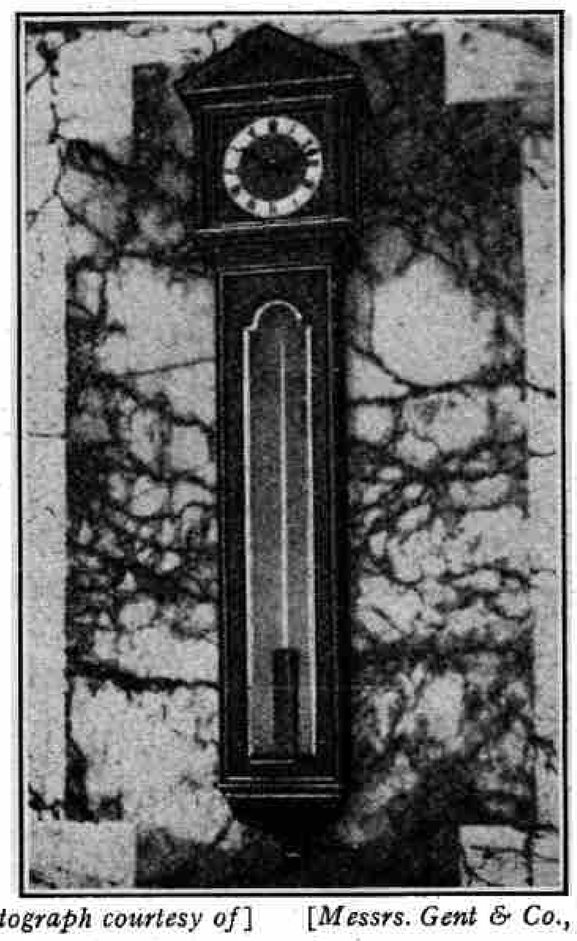
No article on electric clocks would be complete without some mention of "Great George," the wonderful clock on the Royal Liver Friendly Society Building overlooking the River Mersey at Liverpool. This clock, which was designed, manufactured and erected by Messrs. Gent & Co. Ltd., of Leicester, is not only the largest turret clock in England, but is also the largest electrically-driven clock in the world.

The Liver Building was opened on Coronation Day, 20th July, 1911. It is a gigantic structure of ferro-concrete, seventeen storeys in height, and is the dominating feature of the river front. In going round this wonderful building one receives an impression of tremendous strength, and it is easy to realise the enormous value of this modern method of building construction.

A visit to the top of this building is a very interesting experience. Stepping into one of the many electric lifts we are carried swiftly and smoothly upward for many storeys until the limit of the lifts is reached. Passing through the room where the electric lift machinery is working away with wonderful ease and precision, we step out into the open air on to the flat roof of the main building. From here we can admire the wonderful view over the busy city, with the river and docks spread out below us like a map. We then ascend a spiral staircase inside one of the towers and again step out into the open to see the same view as before, but with its proportions noticeably altered by the extra height. Looking down we see tiny trams crawling about the city and miniature figures that it is difficult to realise are people as tall as ourselves. If there is a strong wind blowing it is very necessary at this height to hold on to hats and caps very carefully the whole time. Any Meccano boy who visits Liverpool should, if possible, try to obtain permission to visit this wonderful building, which will probably interest him even more than the clock itself.

The Largest Electric Clock in the World

The clock is situated at a height of 220 ft. above the ground level. It has four dials, each 20 ft. in diameter, which, it is interesting to learn, are 2 ft. 6 in. larger than those of "Big Ben" at Westminster. The figures on the dials are 3 ft. in length, and the spaces between the minute divisions are each 14 inches. The minute hands are 14 ft. in length and 3 ft. in width at the centre, and they are built up of sheet copper on a gun metal frame. The ironwork of the dials weighs nearly fifteen tons, and nearly a ton of opal glass was used in the faces. The four pairs of hands with bearing spindles weigh two tons.



Photograph courtesy of] [Messrs. Gent & Co., Ltd.

The Master Clock, or Transmitter, in the Vestibule of Royal Liver Buildings

The total weight of the clock mechanism is four tons, and yet it is automatically driven by a small battery without any winding or attention. The control is so perfect that the clock keeps accurate time to one second per week. The controlling transmitter is synchronised by electric current direct from Greenwich Observatory every day, so that the clock always indicates Greenwich Mean Time.

Each of the four dials of the clock is lit up at night by four powerful electric lamps. An even lighting of the dials is obtained by causing the light from these lamps to be reflected on to a white wall, from which a beautifully diffused light is reflected on to the dial. Special electric mechanism is fitted for switching on these lights at a certain time at night and switching them off again at a certain hour in the morning. This mechanism is automatic and performs its work of switching on and off, day by day, without any attention.

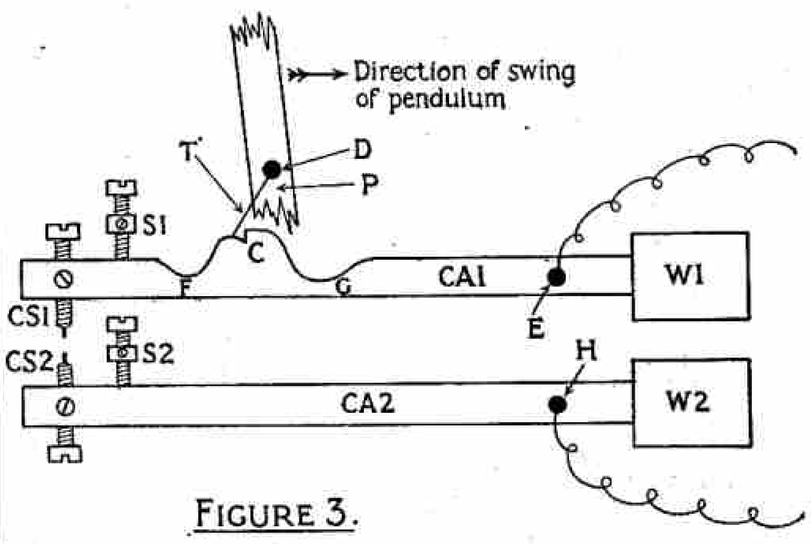


FIGURE 3.

Some idea of the enormous size of "Great George" may be gained from the illustration on page 56, which shows a party of thirty-nine guests lunching round one of the dials on 18th November, 1910, shortly before its erection on the Liver Building.

NEXT MONTH:—

THE ELECTRIC TELEGRAPH



Engineering News of the Month

New Bridge for Zambesi

The necessity for another railway bridge across the Zambesi River has been felt for some time. It has recently been proposed to erect a new bridge further down the river than the wonderful bridge, by which the Rhodesian railway crosses the Zambesi Gorge, below the Victoria Falls. The bridging of the Zambesi at this point by means of a great steel arch was a very wonderful engineering feat. The main arch of the bridge is 500 ft. in length between the centres of the end parts, which are 105 ft. in height. There are also two short end spans 62½ ft. and 87½ ft. in length respectively. The erection of this bridge in a position so far removed from sources of supplies presented difficulties that were overcome only by the dogged perseverance of the engineers.

Commenting on the proposed new bridge "*Modern Transport*" says: "Just over a hundred miles from the mouth of the Zambesi, in Portuguese East Africa and on the northern bank, stands the town of Chindio, the southern terminal of the Central Africa Railway. Opposite, on the southern bank of the river, is the northern terminal of the Trans-Zambesia Railway, opened two years ago. At this point the projected bridge would be built, and would replace the existing ferry service, which can hardly cope with existing traffic, let alone the big expansion which would follow the opening up of the Tete coalfields by a branch railway—another scheme which is linked with the bridge project, and which would materially improve the operating outlook for the railways in this zone.

"The bridge is the key to the development of the British protectorate of Nyasaland, and of a large adjoining portion of Portuguese East Africa. Although owned by various companies, the railway from the port of Beira to Blantyre, Nyasaland, is continuous except for the break at the Zambesi. It is in contemplation to extend the northern extremity of this line as far as the great inland sea of Lake Nyasa, opening up a large tract of some of the richest land in the southern half of Africa."

A Mountain on the Move

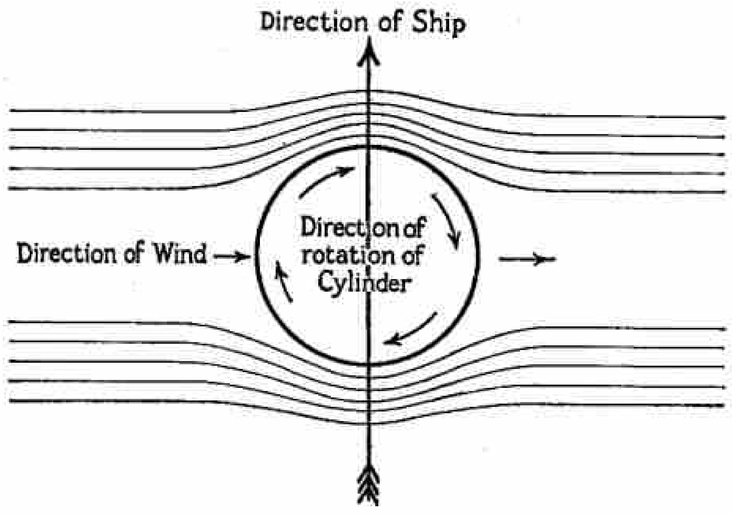
The movement of the mountain in the Rhymney Valley, in Wales, has destroyed part of the main trunk sewer, only just completed, at a cost of nearly a quarter of a million. The trouble is developing and huge fissures are appearing in the main road at the mountain foot. A disturbance on a large scale is feared and a very close inspection is being maintained. Another mountain across the valley is also on the move and is causing the G.W.R. considerable apprehension.

Rotor Principle for Aeroplanes

In last month's "*M.M.*" we gave a short description of the Flettner Rotor ship, in which sails are replaced by rotating cylinders. Important experiments are now being carried out in no less than five countries—England, France, Holland, America and Germany—in the application of the rotor principle to aviation.

In the Flettner rotor ship the propelling force is derived from the wind as in the case of an ordinary sailing vessel, but in a different manner. When both the vertical cylinders or rotors are rotating in the same direction they tend to propel the ship in a direction at right angles to that of the wind.

A little study of the accompanying diagram will make this clear. If the directions of the various arrows are



examined it will be seen that, on reaching the cylinder, the air current divides itself into two streams in order to pass round the obstruction. The cylinder is rotating in the direction shown, and therefore the air stream on one side meets a surface moving in the same direction as itself. This has the effect of accelerating the flow of air, thus producing suction tending to draw the ship forward in the direction of the large arrow. The air stream on the other side encounters a surface moving in an opposite direction to itself and its flow is retarded, thus causing pressure tending to push the ship forward.

The "Googlie" Bowler

It is interesting to know that the rotor ship is really an application of the forces that are at work when a tennis ball, to which spin has been imparted, deviates from the straight path. The same principle explains the "drift" of projectiles fired from rifled guns and the remarkable effects produced by a "googlie" bowler.

The experimental work already carried out in the application of the rotor principle to aeroplanes appears to have established that rotating cylinders in place of wings should support an aeroplane in flight, and that the lift per horse power with rotors should be greater than that attainable with wings. It has been found that even a small cylinder built into the wing of an aeroplane produces a perceptible increase in lifting power.

A Problem Solved?

In the Flettner ship the cylinders are vertical, but in an aeroplane they are placed horizontally across the machine in the same position as an ordinary wing. The cylinder is rotated by the aeroplane engine and its effect is exactly the same as in the rotor ship. The accelerated stream of air flowing over the cylinder produces an upward pull, and the stream flowing under the cylinder produces an upward push, the combined effect being a very strong lift.

The powerful lift obtainable by rotors suggests the possibility that this principle may go far towards solving the problem of the helicopter—that is an aeroplane capable of rising directly from the ground without a preliminary run to attain the necessary lift, and news of future developments in this connection will be eagerly awaited.

New British Battleships

Details of the "*Nelson*" and the "*Rodney*," the two battleships that Great Britain was authorised to build under the terms of the Washington Treaty, have become available through a statement made by Captain H. H. Hough, Director of Naval Intelligence in the United States Navy, to a sub-committee of the United States Congress. The particular interest aroused by these vessels, which were laid down two years ago, lies in the fact that they are the first British capital ships that may be regarded as embodying to the full the lessons of the war in general, and the battle of Jutland in particular, as viewed by British Naval experts.

Armoured Decks

The new vessels are 702 ft. in length on the water line. Their greatest breadth is 106 ft.—greater than that of any other ships in the world—and they have a mean draught of 30 ft. at their standard displacement of 35,000 tons. Their speed will be about 21 knots, that is the same as that of the pre-war "Iron Dukes." The thickness of their belt armour will be 14 in.—an inch more than that of previous ships, and the decks will be specially armoured to resist bomb attacks from the air or high-angle fire.

It is very probable that the "*Nelson*" and "*Rodney*" will have no funnels visible, and that the products of the furnaces will be carried off by pipes running along the

side of the ship and discharging the fumes through an escape valve in the stern. There should be little difficulty about this, as all modern battleships use oil fuel, which gives out very little smoke except when the speed is being changed.

The armament of the ships as described by Captain Hough is particularly interesting. It will consist of nine 16 in. guns mounted in triple turrets all placed in the forward part of the ship. Previously no more than eight 16 in. guns have been carried by one vessel. In addition there are to be twelve or sixteen 6 in. guns mounted in pairs in light closed turrets.

The grouping of three guns in one turret permits a more numerous armament to be carried for a given weight than would be possible with two-gun turrets. The effect of placing all three turrets forward will simplify the layout of boilers and machinery. The magazines will be grouped forward also, and a long armour belt extending three parts of the length of the ship will no longer be necessary for their protection. Possibly there may be more than one armoured deck in the ships so as to give a series of protective shields against attacks from the air.

It has been objected that the placing of all three gun turrets forward would have the drawback of depriving the ships of stern fire. There appears to be little force in this objection, however, because the turrets can be turned so that the guns completely cover all but about 20 degrees from the centre line of the ship.

It is stated that the 16 in. guns are to be 50 calibres in length, and if so they will be the most powerful guns afloat.

When these two new battleships are completed Great Britain, under the Washington Treaty, must discard the four "*King George V.*" ships, and the Treaty also precludes us from laying down another capital ship before the year 1931.

Motor 'Bus that runs on Rail or Road

The interesting experiment is being tried in the Transvaal of using a combined road and rail motor omnibus. According to "*The Times*," a vehicle of this type, built at Johannesburg, is now being tested on the Naboomspruit-Springbok Flats. On the road-rail the omnibus has its front axle supported on a bogie running on the rail, while the driving wheels run on wheelways. The motor is of 36 h.p., water cooled, and capable of running on motor spirit or producer gas from a Parker gas producer, using charcoal as fuel. The front wheels of the bus are solid, while the rear wheels have twin giant pneumatic tyres. It is stated that a speed of 20 miles an hour is attained, and that a load can be hauled up a gradient of one in twenty.

The value of the vehicle lies in its ability to leave the track at any point and discharge its passengers and goods where required, whether at a station, post-office, or hotel.

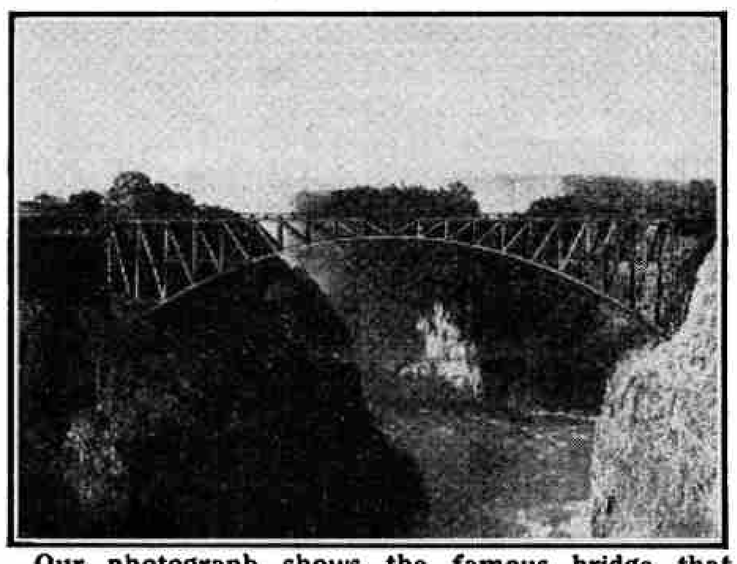
London Automatic Telephones

The hand-operated telephone system of London is being converted into an automatic switching system. The work was commenced some little time ago, but it is estimated that 15 years will be required to complete it.

Not only does the automatic system give greater efficiency, but it also eliminates the monotonous daily routine of the switchboard attendants. Another great advantage of the automatic system is that the service at night is as good as during the day.

The automatic telephone exchange is a most intricate piece of mechanism and is operated by the subscriber. He works a dial on his instrument in a somewhat similar manner to that in which the embossing machines at railway stations emboss one's name on a strip of aluminium, after a penny has been placed in the slot.

A Famous Bridge



Our photograph shows the famous bridge that spans the gorge of the Zambesi, below Victoria Falls. The Bridge made possible the construction of the Cape to Cairo Railway, and it is one of the loftiest bridges in the world. At the Victoria Falls the river is a mile in width, and the Falls 400 ft. in height. The Bridge is so close to the Falls that the trains are often delayed by spray! As is mentioned on the previous page, it is now proposed to construct another bridge across the Zambesi.

Incidentally, a wonderful development of the telephone is now the subject of experiment in the United States. With this system a typist will be able to type at a speed of at least 30 words a minute messages given to her from as great a distance as 5,000 miles. The system is already in use by our own Post Office on several long trunk lines, and the Americans are now planning to extend the system for the use of private individuals.

The Meccano Idea

Steel Houses Made Easy

We reprint the article below from the "Westminster Gazette," by permission of the Editor. We feel sure that our readers will find it interesting.—EDITOR.

HOUSES put together like a Meccano set enabling father and son to bring their happy experience of playtime to the making of a permanent home are the very latest invention.

Perhaps the new demand for steel houses was bound to bring this development about in time, but an eminent engineer, Mr. J. C. Telford, O.B.E., has been the first to apply the Meccano idea to the solution of the housing problem. He has been so successful in the attempt that Birmingham, which had refused to have anything to do with steel houses, has placed an order for three pairs of experimental villas, and other corporations have followed this lead.

Much is being written about steel houses, but as a fact few of the structures under discussion are really steel bungalows. They are steel and cardboard, or steel and wood, or steel and concrete, and nearly all require a certain amount of expert labour in construction.

A Few Hours' Work

This astonishing Telford patent provides for an all-steel house which a youth, who has played with a good set of Meccano, can construct. In the course of a few hours father and son working together, and getting great fun out of the job, can put together a complete and commodious villa to house permanently the entire family. It is actually the first real revolution in home-making since the housing problem became acute.

There is no skilled labour required from beginning to end, and another of the advantages is that there are no wet materials employed that have to be dried out before the new home can be occupied. When pater and Johnny have done their job of work and play, the house that Johnny built is immediately available for residence.

Mr. Telford explained his momentous invention to a correspondent in an interview, and particularly stressed the fact that the whole fabric is made on the fascinating Meccano principle.

Pipes Fixed In

"Each house consists of a living-room, kitchen, bathroom, scullery, and coal cupboard on the ground floor," he said, "with three good bedrooms above. Everything possible is made of steel, even to the staircase, and every component part is made on the mass-production principle and has only to be fixed in place by bolts exactly as the boy makes his wonderful bridges and crane in the playroom. Even pipes for water, gas, or electricity are already fixed on the steel plates and have only to be joined by a screw union.

"The houses are made with a six-inch cavity wall, which is in contact with the roof and also the exterior of the chimney flues. The latter are made of cast-iron pipes, and any heat transmitted by the chimney is re-transmitted round the house by virtue of the contact of these flue pipes."

The whole structure is made of pressed steel plates, and no stanchions are required, as the plates are pressed in the form of a box and bolted together by the turned-in flanges. It is the simple Meccano idea all through.

An Artistic Lining

This being so, it is possible for each amateur or professional assembler to add bay windows or turrets or any other fanciful features his taste may direct. He may also exercise personal judgment in treating the interiors, and the happy use of such durable and adaptable material as "SX" board will give a strong, non-conducting, and artistic alternative lining. The commonly heard objection to steel houses that they must have a monotonous uniformity is therefore removed.

A confidential report from the Ministry of Health indicates that these Meccano villas are likely to be regarded with warm approval. Municipalities desiring to erect sample houses for demonstration purposes will be granted a subsidy by the Ministry so that these novel Meccano houses may be accepted as one of the approved solutions of the housing problem.

Handling Goods on the Docks

Labour-Saving Machines in Warehouses

EVERYBODY knows that goods from foreign countries are brought to this country by sea, landed at one of the great ports and then distributed to their various destinations. Probably, however, very few people know the vast amount of organisation necessary to carry on the work of the docks.

Handling Explosives

Let us start at the moment when a steamer has been safely berthed and when the great dockside cranes—electric, steam, or hydraulic—are at work discharging her cargo. A certain quantity of the goods landed is taken away at once in special vehicles waiting for that purpose, but by far the greater proportion of the cargo has to remain on the quay. Goods are not allowed to be kept on the quay for an indefinite time, however, otherwise the congestion would become very serious, and usually, if merchandise is not removed within about 48 hours, a special charge called "penalty rent" or some similar name, comes into force.

Certain kinds of traffic, however, are never allowed to touch the quay at all. These include explosive goods, which either have a vehicle waiting to receive them and take them away or they are carried off by the dock authorities to a place of safety, at the expense of the owners of the traffic. The same thing applies to any kind of goods that would be likely to contaminate other goods lying near.

All docks have ample railway sidings giving direct connection with the main railway lines, and also with the large warehouses standing near by. Traffic that is ready for immediate despatch is carefully stowed into trucks, and if these trucks are open and the traffic is of a perishable or fragile nature it must be properly sheeted to protect it from the weather. Some traffic, of course, is not sent by rail, but by horse vans or motor lorries.

Bonded Warehouses

For various reasons, however, it is not always convenient for goods to be sent forward direct. For instance, the goods may not have been consigned to any particular buyer, and the shippers may be relying on the consignees to find a buyer after the goods reach this country. Again, it may be that the buyers are not ready to receive the goods. In all such cases storage in a warehouse is necessary.

Warehouses may be of one or more storeys, but a single-storey warehouse is better, not only because it costs less to build but also because the goods it contains can be handled more easily, and it can be better lighted by means of a glazed roof.

In all warehouses special attention is given to the prevention of fire. Most warehouses have a sprinkler or other system installed, so that if at any time the temperature rises above a certain point water is automatically turned on.

A certain number of warehouses at all docks are "Bonded," that is, they are buildings approved by the Customs Authorities for the storage of dutiable goods. Whereas in the ordinary way duty must be paid on goods immediately on arrival at the docks, goods stored in Bonded warehouses are not liable for duty until they leave the warehouse for final delivery.

Making Gravity Help

At the warehouses, goods are unloaded from trucks by cranes of all types. Some of these cranes travel about and do their work so cleverly that they appear almost human when in action. Whenever possible, goods are stacked by means of "stackers," which usually consist of square-shaped rollers fixed in a frame and turned by electric or other power. The traffic to be stacked is fed to the end of a series of these rollers, and these carry the packages to the top of the stack and place them in the desired position. Bale lifters, on the same principle as the Meccano model No. 443, are used for handling the larger bales of wool, cotton, etc.

Delivery of traffic from the warehouse is often effected by means of "gravity runways," which consist of a number of rollers fixed in a frame down which gradually run the goods to be delivered. Delivery can also be effected by the same cranes that were used to receive the goods into the warehouse, but the special advantage of gravity runways is that they require no power to work them. Generally speaking, in all warehouses man-handling is reduced to its lowest possible limit in order to keep down costs and to speed-up the work.

So far we have spoken of traffic handling in general, and it will be interesting now to say a few words on the treatment of various individual traffics.

Handling Cotton and Wool

Cotton, for instance, is packed in huge bales, and contrary to what might be expected, the worst-packed bales are the American. They are, therefore, extremely difficult to handle, as when they arrive they have often burst in various places and the raw cotton is protruding. On the other hand Egyptian cotton is carefully press-packed, enabling a larger quantity to be packed into one bale and rendering the handling of the bales very much easier.

Wool also arrives in large bales, and in this traffic what are known as "extra services" are often required. These services include mending bales and setting out for show, the latter involving the removal of one corner from each bale in order that prospective buyers may examine the contents.

Precautions against fire must be redoubled in the case of inflammable merchandise like cotton and wool. Warehouses intended for the storage of this class of traffic are generally divided into fire-tight sections, so that in the event of one part of the warehouse catching fire the other portions may be saved. Also an ample supply of water must be kept at hand, and this may be provided for by means of a large tank on the roof.

Tobacco, Canned Goods and Grain

Tobacco is usually packed in great barrels called "tierces," weighing about 7,800 lb. each. The Customs Authorities require that this traffic should be weighed, and large scales are therefore provided. The hoops are slipped off the barrels by means of machinery, leaving the tobacco standing up in its own bulk, and the barrels are re-fixed after weighing. Tobacco is often kept for years in store in order that it may mature.

Wines and spirits also often remain in store for a long period. This traffic is usually stored by means of barrel racks which make the removal of casks an easy matter.

Canned goods are imported from America and other countries in huge quantities, and a large amount of this traffic usually goes into warehouses. The "extra services" commonly



Photo courtesy [*Messrs. Henry Simon Ltd.*

Portable Combined Piler Stacking Sacks

required on this class of goods include opening of cases, examining for damaged tins, removal of blown tins, labelling, etc.

Grain, which is packed in bags, has to be carefully stored to prevent bursting. Before the war there was a tradition that it should never be piled more than five bags high. This, of course, involved a great loss of space, and during the war, when all available space was required, this convention came to an end, and in some cases the grain was stored over 80 bags high! If the piling is done by machinery under expert supervision, there is no real risk of danger.

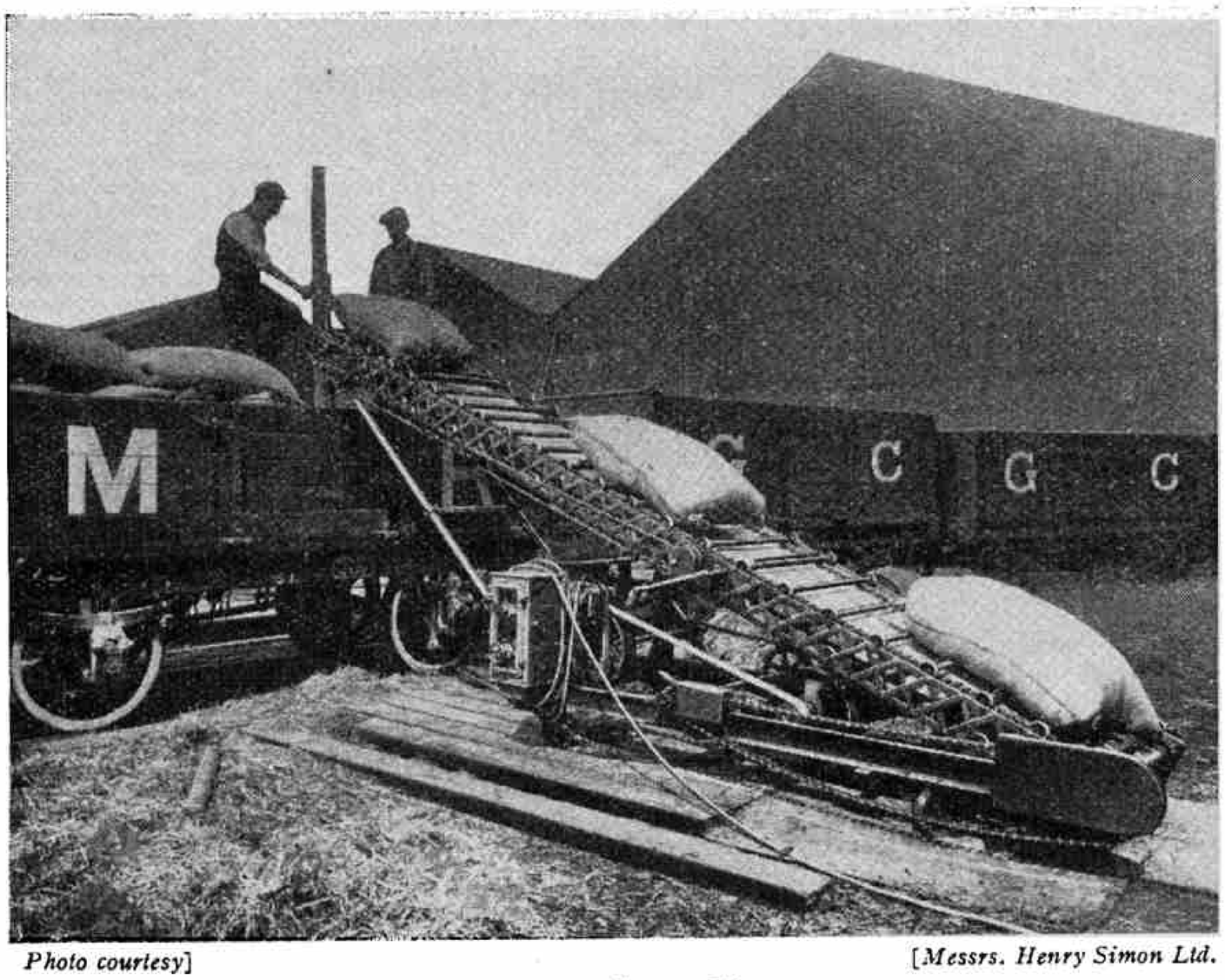
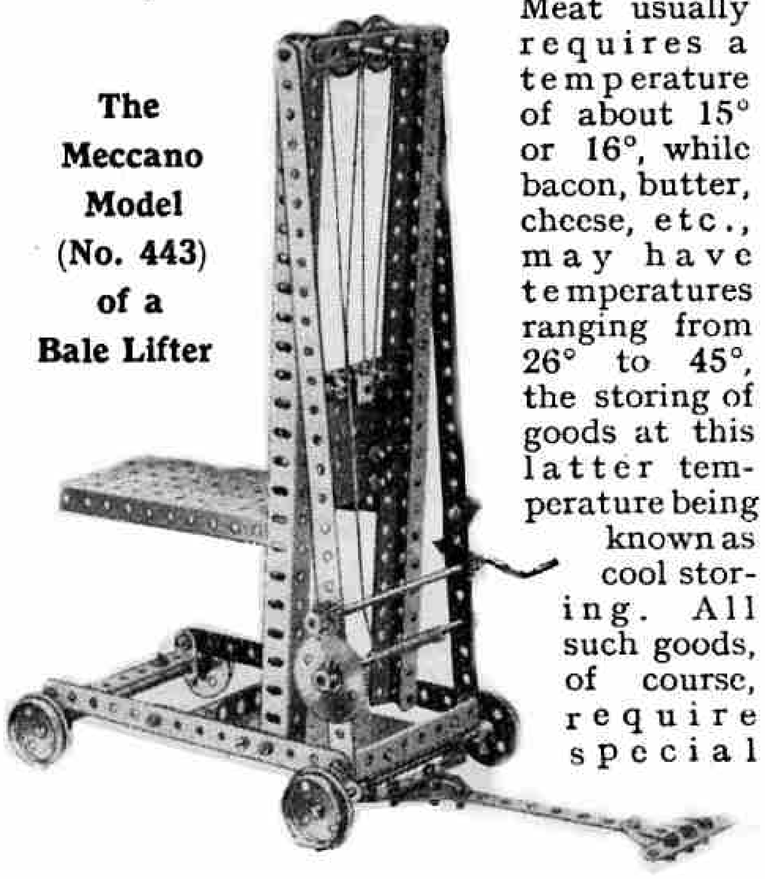


Photo courtesy] [*Messrs. Henry Simon Ltd.*

Loading Railway Wagons

Cold Storage

A detailed description of all the many classes of goods dealt with in docks and warehouses would take up a great deal of space and be very monotonous, but our article would not be complete without some mention of cold storage. Varying degrees of low temperature are required for different kinds of traffic. Meat usually requires a temperature of about 15° or 16°, while bacon, butter, cheese, etc., may have temperatures ranging from 26° to 45°, the storing of goods at this latter temperature being known as cool storing. All such goods, of course, require special handling. Refrigerated meat, for instance, has to be transported in insulated vans, either railway or motor. The interior of these vans is entirely covered with cork to prevent a rise in temperature, and the vans are specially locked.



The Meccano Model (No. 443) of a Bale Lifter

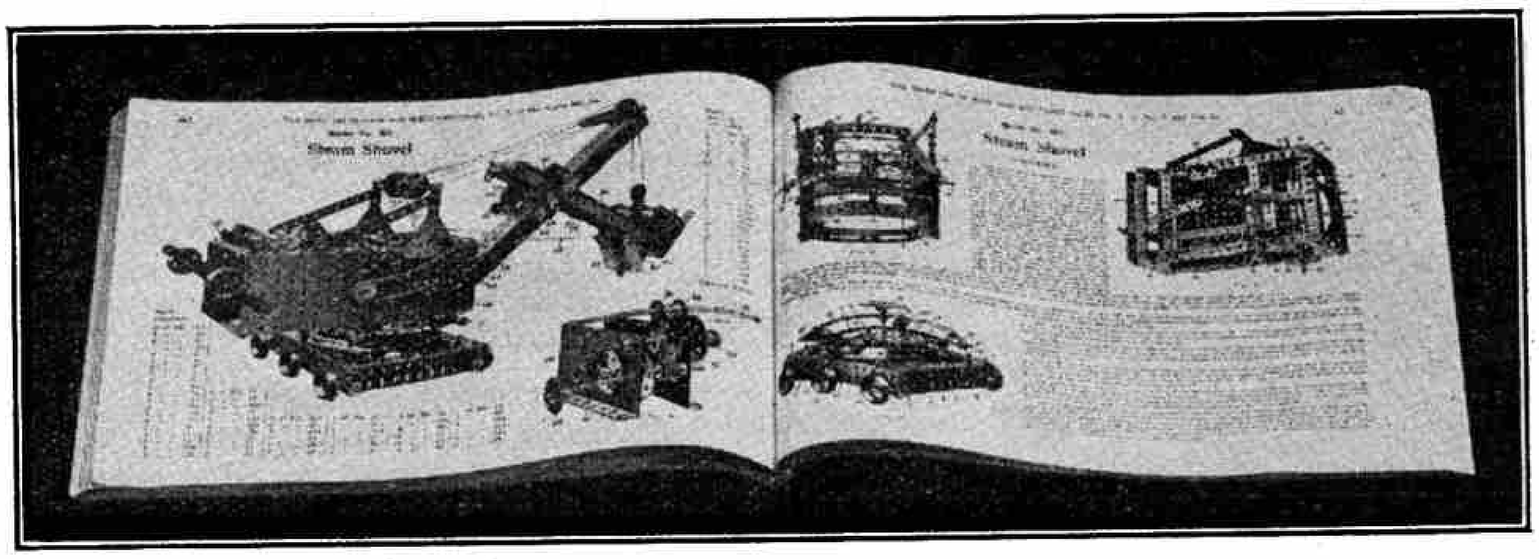
The cold storage of eggs is a specially difficult problem. A temperature of a little over 30° is required, and only a margin of about one-eighth of a degree can be allowed either way. If the eggs are kept at too low a temperature they crack, while if the temperature is too high they go bad. In order, therefore, to keep a close watch on the temperature, an electric alarm is installed which automatically gives warning by means of a bell whenever the safe limits are exceeded.

All the various services carried out at docks and in warehouses have, of course, to be paid for. The first charge incurred is that for port dues payable on all goods entering the particular port. Next is the landing charge, which at some ports is charged on all goods and at others only on goods that actually touch the quay. This charge also covers rent for the use of the quay during the few hours the traffic remains there. A further charge is made for the hauling or cartage of goods from quay to warehouse.

As for the actual warehousing, a charge is made for receiving, storing and re-delivery to vehicles at the proper time, with an additional sum per week, usually a few pence, for rent while the goods are in store. In the case of tobacco and other traffics which may be stored for years, the rent charge is often considerably reduced after the first year. Extra services are charged in addition, usually at cost plus a small percentage for profit, but in some traffics such as wool, where extra services are more often performed than not, most of these extras are included in one rate called a consolidated rate.

It is not easy in a short article to give an adequate idea of the intensely interesting methods and mechanism employed in handling goods at docks and in warehouses, but it is hoped that enough has been said to encourage Meccano boys to take the first opportunity that comes along to see these things for themselves.

The New Meccano Manual



There are three Manuals, the 0 Manual for simple models built with the 00 and 0 Outfits, the 0–3 Manual comprising models built with any of the Outfits up to and including No. 3, and the Complete Manual, which comprises a selection of models that may be built with every Outfit up to a No. 7.

This latter Manual is a very fine publication and should be in the hands of every Meccano boy. It includes instructions for building 389 models, including most of the models shown in the former No. 3 Manual, the publication of which is now discontinued. The new edition (No. 24) of the Complete Manual is beautifully illustrated in half-tone and most of the models have recently been revised, and very greatly improved by the introduction of new parts that have been added to the Meccano system during the past year. Several new models have been included for the first time, including some of those published in recent numbers of the "*M.M.*"

Prices of Manuals.

0 Manual	(postage free)	6d.
0–3 ,,	,,	1/2
Complete Manual	,,	2/10

How to Run a Miniature Railway

(*Continued from page* 81)

their designers pay little attention to appearance so long as the locos do their work satisfactorily. British loco designers, while equally keen on efficiency, always endeavour to secure a good appearance for their engines by placing as much of the mechanism as possible under cover, and giving the whole loco a high outward finish. American and Canadian engines on the other hand appear to have as much as possible of their mechanism on the outside.

American and Canadian locos are, of course, much larger than ours—a direct result of the scale on which the bridges in these countries are built. The British designer is severely limited by the "loading gauge," that is the height that must not be exceeded by any railway vehicle. On British railways the gauge is 13 ft. 5½ in., whereas in America it is 16 ft.

American locos differ from ours also in another respect. British locos are built with a view to each one having a very long working life, whereas in America 10 years is considered a good life for any loco, after which it is ready to be scrapped to make way for something more up-to-date.

NEXT MONTH:

The Use of Meccano in Miniature Railways

Lucky Dundee Boys

That enterprising firm of Meccano dealers, Messrs. Draffen and Jarvie Ltd. (Nethergate, Dundee), recently organised a Puzzle Competition in which a special Meccano Cross-Word Puzzle was drawn up and printed on sheets that were given to applicants at the toy store. To every boy who correctly solved the puzzle a free subscription to the *Meccano Magazine* for a whole year was awarded. The Competition was a great success and we congratulate the organisers on their enterprise in this connection. We think it would certainly be a good idea if every other toy store followed this example.

Typewriting for Authors

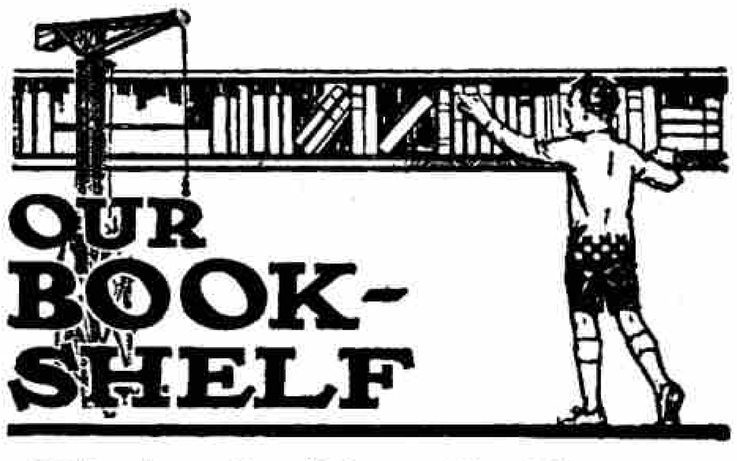
The value of typewriting to anyone with literary aspirations cannot be over-estimated. Editors have such an enormous amount of material to read through day by day that, as a rule, they insist on all contributions being typewritten. The fact that a contribution submitted to an editor is typewritten may indeed secure its acceptance where the same article, if handwritten, would have been pushed on one side without consideration. Messrs. A. W. North (47, Parchment Street, Winchester), who are regular advertisers in our columns, have opened a typewriting department for the quick and accurate copying of articles, letters, circulars, etc., and any of our readers who require service of this kind would do well to communicate with this firm.

Block-Setting Cranes—(*Continued from page* 55)

however, and it was decided to call in engineers from abroad to repair the damage and to report on the improvement of the work generally, as no English engineers had had any experience of this class of work.

During the reigns of Elizabeth and James, various additions to the harbour works were made, and subsequently such distinguished engineers as Perry, Smeaton, Rennie, and Telford all examined the question. Subsequently, considerable sums were spent on improving and extending the harbour works, but no satisfactory results were obtained until after the invention of Portland Cement, which revolutionised this branch of engineering.

(*To be continued*)



Readers frequently write to me asking if I can recommend books that are both of interest and of use. In this column I hope to review books that I consider specially appeal to Meccano boys. I do not actually supply these books, which may be obtained either through any bookseller or direct from the publishers.—EDITOR.

Stamp Collecting for All

By Stanley Phillips.

(Stanley Gibbons Ltd., London, W.C.2, price 1/–).

To the boy first taking up stamp collecting this fascinating hobby appears fairly simple and straightforward, but as a matter of fact there are many difficulties which, if not properly explained, are apt to cause the young collector to lose heart and abandon the hobby. "*Stamp Collecting for All*," by Stanley Phillips, is specially written to make the way easy for the beginner, and to point out the various pitfalls so that they may easily be avoided. The book is well illustrated and can be recommended strongly to any boy who has just commenced, or who is thinking of commencing, this delightful hobby.

The Radio Year Book

(Sir Isaac Pitman & Sons Ltd., London, price 1/6).

This handy volume, now in its third year, fully maintains its value as a book of reference for all interested in radio. The amount of ground it covers is remarkable, and this result has been attained by skilful condensation. All radio enthusiasts, whether interested in broadcasting or in the more technical aspects such as wireless television, are fully catered for, and broadcasting enthusiasts will examine with interest the photographs of various announcers and "uncles" at the B.B.C. stations, and of a number of the favourite broadcasting artists. The book includes a list of stations and radio societies and a useful trade directory.

Photographic Handbook

(Burroughs & Wellcome Ltd. Price 1/6).

The "Wellcome" Photographic Handbook in its pleasant green cover comes year by year as an old friend to all photographers desirous of getting the utmost out of their hobby. The 1925 edition retains all the valuable features of the past, and in addition has many interesting new features. Pages packed with information on the most accurate and at the same time the simplest methods of development and printing are followed by tables giving the comparative speeds of all well-known makes of plates, films and bromide and gaslight papers, and at the back of the book is the well-known "Wellcome" Exposure Calculator, possibly to many readers the most valuable feature of the book.

Radio for the Millions

(Hodder & Stoughton Ltd., London. Price 2/6).

"*Radio for the Millions who Listen*" is the title of an interesting book by "Experimenter" of the Manchester Evening News.

In this delightful book the author aims at assisting two classes of amateurs—those who are intending to take up wireless, and those who already possess some apparatus and desire to know more intimately how it works. For either of these readers this book can be recommended. It is written in a clear and easy style, and even the most complicated subjects are placed before the reader in an admirably lucid manner.

"The Story of Broadcasting."

By Arthur Burrows.

(Cassell & Co. Price 3/6).

Mr. Burrows, once familiarly and even affectionately known throughout Great Britain as "Uncle Arthur" at 2LO, is now one of the senior officials of the British Broadcasting Company. In this volume he presents information on subjects interesting to hundreds of thousands of listeners. He explains in a homely way the theory of wireless; sketches its development in peace and in war; reveals many romantic facts associated with the growth of broadcasting in Britain, and takes readers behind the scenes at the London and Provincial Broadcasting Stations. Finally there are startling speculations upon the future. Every page has a strong appeal for all wireless enthusiasts and the book will prove very interesting even to the general reader.

"Wireless World."

The latest issue of the *Wireless World* to hand—No. 283—contains detailed instructions for making up a high-grade power amplifier having two low frequency stages. The design is not at all complicated, and the average beginner should not find it difficult to make this apparatus. The mechanical construction of a new electron relay, invented by an American is described, and the applications of the relay are discussed. Among the interesting illustrations is one shown of Mr. Max Howden (3 BQ) of Box Hill, Victoria, the first Australian amateur to effect two-way communication with America. The photograph shows the simplicity of the apparatus used by Mr. Howden. The regular features of the paper are fully up to their usual high standard of interest.

A Useful Transformer

We have recently tested a transformer made by the Electro Supplies Co. (of 19a, The Broadway, Wimbledon, S.W.19). This transformer is a well-constructed piece of apparatus wound for a primary current of from 200 to 220 volts and gives a secondary current of 6v. 5 amps. It was tested on 100v. and gave 3v., which current remained practically constant as the load increased. After two hours on full load (5 amps.) there was no heating-up, showing that the transformer is decidedly well-insulated. An interesting feature is the wide contacts of the adapter with which the transformer is fitted, this being a great improvement on the usual style.

REVO
THE NAME FOR PERFECT RADIO.

Revo LIGHTWEIGHT HEADPHONES

21/- EACH
Revo LittleGem Crystal Set, 6/-
Not a Toy—works perfectly
Revo Loud Speakers
48/- & 80/-
each, complete with cord. Experts say—They are the best LOUD SPEAKERS made.
The phones that carry a twelve months' Guarantee

Obtainable from any dealer or the manufacturers:
THE CABLE ACCESSORIES CO. LTD., TIPTON, STAFFS.
London Depot - - 28, SHOE LANE, E.C.4.

Competition Corner

"MY FAVOURITE RAILWAY" ESSAY COMPETITION

Essay Competitions appeal strongly to a large section of our readers, particularly when the subject is something of an engineering nature. This month we announce an Essay Competition on the following subject: "MY FAVOURITE RAILWAY AND WHY I PREFER IT."

The competition will be divided into two sections—(A) for those of 14 and over, and (B) for those under 14, and four prizes will be awarded—Meccano goods to the value of £1/1/0 and 10/6 for the first and second in each section respectively.

Essays must not exceed 1,000 words in length and must be neatly written on one side of the paper only, with the competitor's name, address and age on the back of each sheet.

Closing date, 28th February (overseas, 31st May).

Third Drawing Competition

Our second Drawing Competition has produced quite a deluge of entries, the majority of them good and many of them really excellent. We are now announcing a Third Contest, the subject of which is: "AN ELECTRIC TRAMCAR WITH OVERHEAD TROLLEY." Drawings may be made either in pencil or ink.

The contest will be divided into class (A) for those of 16 years and over, and class (B) for those under 16. There will be four prizes—Meccano products, to be chosen from our current catalogue by the winners, to the value of 10/6 and 5/– respectively for the first and second in each section.

Closing date, 28th February (Overseas, 31st May).

12th Photo Competition

The demand for more Photographic Competitions continues unabated, and this month we are announcing our Twelfth Competition. The subject is "A BRIDGE, VIADUCT, OR AQUEDUCT." Almost every reader lives within reach of various structures of this kind, and it is hoped that there will be a good entry for this contest even if the photograph shows only the footbridge at the local railway station!

Following our usual procedure the contest will be divided into two sections—(A) competitors under 14 years of age, and (B) competitors 14 years and over.

Every competitor must write his name, address and age on the back of every photograph he submits, and must also state by whom the photo was developed and printed. In the event of a tie for a prize, photographs that have been developed and printed by the competitor himself will receive preference. Envelopes containing entries should be marked "Photo Contest" in the top left-hand corner.

Four prizes are offered in this contest—Meccano Goods to the value of 10/6 and 5/– as first and second prizes respectively, in each section.

The closing date for readers in the United Kingdom is 31st March, and for readers Overseas, 30th June.

"Suggestion" Competition

From time to time we receive various suggestions for new forms of competition. Many of these are of little use, either because we have already had such a competition in the past, or because the scheme proposed is impracticable for various reasons. In order to try to find out what ideas our readers really have on this matter, we have decided to institute this month a special "Suggestion" competition, the subject being: "MY SUGGESTION FOR A NEW COMPETITION SUITABLE FOR THE '*M.M.*'"

The description of the competition suggested should be as brief as possible, consistant with clear explanation. If the suggestion is based upon a competition recently seen by a reader in another paper or magazine, this should be stated when submitting the idea.

We draw the attention of intending competitors to the fact that the following competitions have already been conducted in the "*M.M.*": Lynx-Eyed (identification of fragments of models from the Meccano Manual); Sharp Eyes (finding mistakes in drawing); Photographic; Essays; Drawing; Stamp Bargain Hunt.

A Meccano Radio Receiver or pair Double Headphones (at the winner's choice) will be awarded to the four most original, and at the same time, practicable suggestions.

Last date for receiving entries, 28th February (Overseas, 31st May).

Competition Closing Dates:

Eleventh Photo.	**28th February.**
"My Favourite Railway" Essay	**28th February.**
Third Drawing	**28th February**
"Suggestions"	**28th February.**
Twelfth Photo.	**31st March.**
OVERSEAS:	
"Sharp Eyes"	**30th April.**
Bargain Hunt	**30th April.**
Second Drawing	**30th April.**
Third Drawing	**31st May.**
Eleventh Photo.	**31st May.**
Cycling Hints	**31st May.**
"Suggestions"	**31st May.**
Twelfth Photo.	**30th June.**

Result: Christmas Puzzle Contest

We expected our Christmas puzzle contest to prove popular, but we were more than surprised at the remarkably large number of entries that poured in from boys and girls of all ages. This big response entailed an enormous amount of work, as we make a point of examining closely every individual entry. Several competitors sent in correct solutions to all the puzzles they selected, and the standard of excellence in general was very high. After consideration, and in accordance with the rules governing this contest, in which neatness played an important part, the prizes have been awarded as follows:—

FIRST PRIZE (Hornby No. 2 Goods Set), G. E. Selby, Ben Rhydding, Yorkshire; SECOND PRIZE (Hornby No. 2 Tank Loco), W. Renshaw, Sheffield. Meccano Radio Receivers or Headphones—S. R. Mc E. Porter, Northfield, Birmingham, T. W. Gribble, Ipswich, and W. Clark, Grove Hill, Middlesbrough.

We congratulate these competitors on their success, and hope that those who were not successful on this occasion will have better luck in future competitions.

Result: "Bargain Hunt"

Evidently most of our readers interested in stamp collecting took part in the second "Bargain Hunt" Contest. Several competitors agreed as to the first two bargains, but there were varied opinions about the third.

All votes were carefully counted with the following results: — (1) Messrs. Amber & Wright (London); 2, Messrs. Lisburn & Townsend (Liverpool); 3, Nelson T. Hillier (Horsmonden). The only entry bearing these names in their correct order was sent in by J. W. Johnson (Wimbledon, London), who has therefore been awarded the first prize of a packet of stamps, value £1 1s., or stamps to that value, to be chosen from any one firm advertising in the "*M.M.*"

As no other competitors sent in correct entries the remaining three prizes have been awarded to those whose post-cards corresponded most closely with the general order of the voting. Therefore C. J. Miller (Southampton), H. W. Deyer (Exeter), and J. S. Lowe (Caithness), are each entitled to a free advertisement in the "*M.M.*" in which to announce their own bargains or wants. The prize for the dealer in whose advertisement the biggest stamp bargain was found has been awarded to Messrs. Amber & Wright (London), who are regular advertisers in the "*M.M.*"

The two consolation prizes offered by Nelson T. Hillier to the best "runners-up" under and over 12 years of age respectively have been won by E. J. Baxter (New Ferry, Cheshire), collection of 1,000 different stamps; T. W. Gribble (Ipswich), standard catalogue of postage stamps, 1925 edition.

Result: Third "Lynx-Eyed Contest"

The numerous entries received in this competition prove that its popularity is undiminished. Although many hours were spent in trying to make these puzzle pictures much more difficult than the last set, no less than 32 competitors succeeded in solving them all! The correct solutions of the three sets of puzzle pictures will be published in the May issue of the "*M.M.*"

In order that each of the 32 successful entrants should receive a prize, the number of consolation prizes has been increased to 29. According to the rules governing a tie, neatness of writing has been taken into consideration. The prize winners are as follows:—

FIRST PRIZE (Hornby No. 2 Pullman Set), C. G. Emmett, West Kensington, London, W.14.

SECOND PRIZE (Meccano No. 1 Radio Receiver), to F. L. Jones, Thornton Heath, Surrey.

THIRD PRIZE (Pair Meccano Headphones), to E. Watson, Blackburn.

Consolation Prizes of Meccano New Complete Manuals or Meccano Writing Pads have been awarded to the following competitors: H. C. Ager (Northampton); N. F. Beckett (Bromley); T. C. Bell-Curr (Arbroath), E. H. Bradshaw (Sheffield), W. A. Bradshaw (Sheffield), P. T. Bourne (Birmingham), A. Bulmer (Tantobie), L. Chilvers (Norwich), C. J. Christmas (Hereford), N. M. Douglas (Inverness), M. S. Y. Fowler (Teddington), L. Fuller (Henfield), R. Harvey (Harrow), R. H. Herbert (Wallasey), R. Hill (W. Smethwick), G. W. Hook (Honiton), P. Horner (Cross Hills), H. Hunter (Belfast), C. B. Kirkby (Burton-on-Trent), R. E. M. Lane (Burton-on-Trent), F. Longley (Dobcross), S. Marsh (Thornton-le-Fylde), R. H. Masters (Ilford), H. Milnes (Barnsley), I. H. Ronald (Arbroath), R. W. Selby (Chard), K. Seymour (London), L. W. Welland (Thames Ditton), R. Wiegold (Luton).

OUR BUSY INVENTORS

RECENT INTERESTING PATENTS

Every day new inventions and ingenious labour-saving devices are being brought into existence, and from time to time the most interesting of these inventions are described and illustrated in these columns. Readers are invited to send particulars (accompanied, if possible, by photographs or rough sketches) of any interesting inventions or devices that may come to their notice. Payment will be made for any contributions used.

Among recent minor inventions the following are perhaps of the greatest general interest :—

A life-saving suit, made of a special mixture of asbestos cloth, that successfully resists heat and flame while also protecting the wearer from the effects of smoke. Clothed in this suit the inventor recently entered a blazing building after it had collapsed, and lay down in the glowing embers without injury.

* * * *

A wonderfully-constructed timepiece, in which there are no hands or gears and which takes its reading by the sun's position in the sky. The instrument is a combination of sun-dial and compass, and is adjusted for the latitude of the particular country in which it is used. The device may be carried in the vest pocket, and is said to be as accurate as more complicated timepieces.

* * * *

A radio receiver that does away with the ordinary head-pieces and allows greater freedom of movement. The ear is entirely enclosed in this new device, and as all external noises are shut out music sounds more natural.

Useful for Motorists

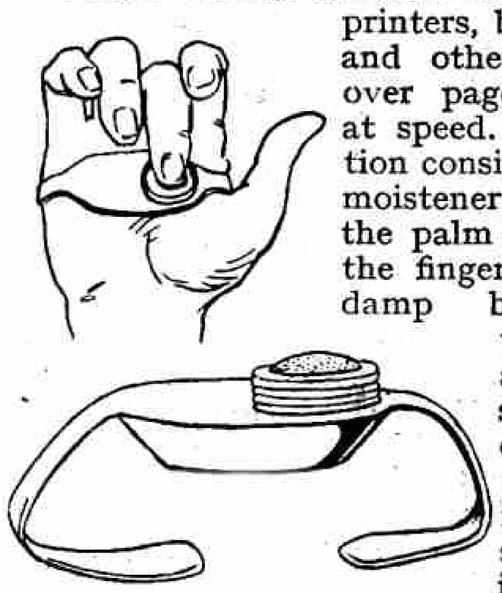
One of the disadvantages of a flash-lamp is the fact that the user must either give up one hand to hold it or else rig up a temporary stand for the light. Even then, this is not always satisfactory, as the light remains fixed upon a single spot instead of following the work. An ingenious device for overcoming this difficulty has recently been placed on the market. In it the flash-lamp is attached to a pair of goggles. The lamp is placed out of the line of vision and a shield protects the eyes from the light to prevent dazzling. Current is supplied from a battery attached to the lamp by means of a flexible wire from the bulb down to the coat pocket. The device ensures that the light will shine exactly in the direction in which the wearer is looking.

Counting Revolutions

An instrument, called the "Oscilloscope," for studying rapidly-moving machinery, has just been perfected. By means of this invention a crankshaft turning at 3000 revolutions a minute is made to appear as if revolving only 30 times a minute. The Oscilloscope will prove of great use in the study of the machinery used in cotton-spinning and similar trades, as any machine running at full speed may be made to look as if it were running at only one hundredth the actual speed. The invention will also be useful in the study of automobile engines and aeroplane motors.

How to Count Banknotes !

This invention is useful to bookkeepers, printers, bank cashiers, and others who turn over pages or papers at speed. The invention consists of a finger moistener that fits in the palm of the hand, the fingers being kept damp by touching them against a piece of sponge mounted on a small metal water reservoir, as shown in the illustration.



Hot Drink Machine

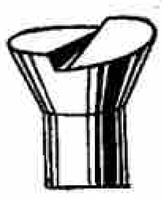
An Italian inventor has made an automatic machine that prepares a cup of hot cocoa by first powdering the cocoa, and adding water and milk, boiled in a separate container. A cup of cocoa will be found ready twelve seconds after a coin has been inserted. The correct amount of milk is heated by a steam jet, and the cocoa and sugar being added, the mixture is well stirred before being deposited in the cup. There are already many slot machines—such as American Soda Fountains—from which a drink may be obtained by the insertion of a coin, but this is the first machine to concoct the drink before serving it.

A Double Lock Bolt

This bolt is a recent engineering patent. It has two nuts, both of which turn in the same direction. But while one is screwed upward, the other is screwed downward until the two lock at the desired point. This movement is the result of the positions of the threads. Any pressure exerted on the nuts only tends to lock them more firmly together. When adjusted they are secure and are not affected by jars or vibrations.

Fool-Proof Screw

To prevent unauthorised people from removing screws from machinery, packing-cases, etc., an inventor has recently devised a screw in which both sides of the head are filed down to an angle, as shown in the accompanying illustration. The blade of the screwdriver engages the screws when turning clockwise, but slips when turning in the opposite direction. This ingenious device ensures that screws may be screwed down tightly, but prevents them being removed with a screwdriver.



OUR MAIL BAG



In this column the Editor replies to letters from his readers, from whom he is always pleased to hear. He receives hundreds of letters each day, but only those that deal with matters of general interest can be dealt with here. Correspondents will help the Editor if they will write neatly in ink and on one side of the paper only.

B. Jordan (Derby).—"I think a Bright Idea is to publish the '*M.M.*' once a fortnight or once a week. My friends think so too, as it is such a long time to wait until the next number is published." We cannot adopt your "bright idea" just yet, Bob !

R. J. Peace (Halifax).—"You have expressed your desire to make the '*M.M.*' the biggest and brightest boys' paper. That it is the brightest is certain, but until each issue is many times its present size, I am afraid Meccano boys will not be satisfied. Cannot you work overtime ?" We do that already, Robert !

P. Evans (Leicester).—Thank you for the cutting you have sent us. You have discovered an error that shows a sad lack of knowledge of the mercantile marine. The error is all the more glaring because the article is supposed to be written by an "expert." Anyone who knows anything at all about ships knows that the "*Majestic*" is not "easily distinguishable by her three red funnels !" The "*Majestic*" is not a Cunarder but is, of course, a White Star boat, and all vessels belonging to this line have *yellow* funnels with black tops.

E. Horsley (Newcastle).—"I am sure Meccano boys would willingly pay 6d. or 1/- per month if you would only make the Magazine three or four times the present size. I earnestly counsel you to consider this suggestion." We are always pleased to hear from our readers, Eric, but if you only realised the work that would be entailed in acceding to your request we feel sure you would not be quite so ambitious in your demand. However, the "*M.M.*" is going forward, and without doubt will continue to grow !

F. Roberts (Batley).—We congratulate you on your success in combining Meccano with your Hornby Train Set. Your goods station with its warehouse and cranes must add very greatly to the interest of your railway, and loading and unloading the miniature sacks must be great fun. Write again soon and give us further details.

G. Watson (Barnstaple).—We hope that by this time you are quite well again and able to look after your large family of pets. The doctor seems to have been fascinated with the Meccano models you built during your long stay in bed. Apparently, he had been under the impression that Meccano was just a toy for children, and we are glad that you were able to put him right !

W. Wilkins (Gloucester).—We are glad that you have "dared" to write again. We never get "fed up" with letters from Meccano boys, and we do not "rave and tear our hair when we see the big pile of letters waiting to be opened each morning." The only time we get really wild is when a boy writes us an interesting letter and forgets to give his address, so that we cannot reply to him !

G. R. Turnbull (Leicester).—We greatly appreciate your opinion that the "*M.M.*" is the best Magazine in the world. We are afraid, however, that it will be some time before we can make it also the biggest in the world, as you desire. During the coming year we are certainly going to "cram the old Mag." with engineering articles, and we shall be glad to hear your opinion of these from time to time.

R. K. Price (Hull).—Our holiday gave us a lot of health and strength, but not enough to publish the "*M.M.*" fortnightly, Ronald ! We may be able to do so a little later, however. If our growth in the future is as rapid as it has been during the last few years, your ideal of 100 pages may soon be reached.

D. S. Zerner (Queensland).—All our readers are keenly interested in kangaroos, and emus, and wild parrots, so tell us all about them and all about your country. If you will send us photos along with your notes we will endeavour to publish them in the "*M.M.*" Thanks for puzzles, which we may be able to use.

T. McGeorge (Maxwelltown).—Cards of Hornby Trains and rolling stock would make a popular series, Tom, but we think boys are rather tired of them after the flood of cigarette cards that has been poured on them during the last few years.

F. Ward (Halifax).—There is to be no big Competition this season, but there will be a number of smaller ones, all of which will be announced in these pages in good time. We hope this good news will turn you from your determination to "lay you doon and dee."

Lives of Famous Engineers—

(*Continued from page* 63)

Brunel's block-making machinery was adopted by the Government, and his prospects seemed bright, but as a matter of fact his troubles were only just beginning. He had the utmost difficulty in finding competent men to work his machines, and added to this was the prolonged delay on the part of the Government in remunerating him for his invention and his services. It was not until 1810, after seven years of desperately hard work and continual worry which seriously affected his health, that he received a final payment, the sum alloted to him being £17,663.

Saw-Mills Disaster

Brunel's other inventions were so numerous that we can only deal with a few of the more important of them. He took out a number of patents for saw-mills, including a method of cutting very thin boards or veneers by means of circular saws of large diameter. To this improvement was due very largely the subsequent extensive application of veneers to wood for ornamental furniture.

About 1806, Brunel commenced the erection of saw-mills at Battersea, in which he invested practically the whole of his available money. Many important processes of mechanical wood-working were carried out for the first time at these mills. Eventually, however, financial difficulties occurred, and these were brought to a head in 1814 by a disastrous fire that resulted in the almost total destruction of the works, which were valued at £24,000.

Invents Shoe-Making Machinery

In 1811, Brunel took out patents for machinery for making shoes. This machinery was so simply constructed that it could be worked by invalid or even crippled soldiers, and the shoes turned out were vastly superior in strength and durability to those made previously, besides being very much cheaper. In the following year Brunel, relying upon the very favourable opinions expressed by various individual members of the Government, prepared machinery sufficient to supply the whole of the Army. A large order was given by the Government and duly executed, but when everything was in full swing the war came to an end, and the Government decided that they no longer required machine-made shoes. The consequence was that Brunel was left with a large stock of shoes, and with heavy liabilities regarding his factory.

Arrested for Debt

The losses incurred at the saw mills and the shoe-making factory combined were very serious. Brunel's conduct throughout the various transactions was thoroughly honourable, but unfortunately some of those to whom he confided his financial interests failed to carry out the duties they had undertaken. The failure of a bank brought about a hopeless state of affairs, and in 1821 Brunel was arrested for debt. As soon as his desperate position became known his numerous and influential friends put forward every effort to help him, and ultimately, in consideration of his distinguished services, particularly in regard to the block-making machinery, the Government voted the sum of £5,000 to discharge his debts.

(*Continued in next column*)

"*M.M.*" Binders



This spring-back binder for *Meccano Magazines* has a strong stiff back, covered with imitation leather, tastefully tooled. It takes a large number of copies and keeps them neat and clean. In black, lettered gold. Price 3/– each, post free.

MECCANO LTD., LIVERPOOL.

Designs Suspension Bridges

In 1821 the French Government decided upon the erection of two suspension bridges on the island then called Bourbon, but since 1848 known as Reunion. This island is one of the Mascarene group in the Indian Ocean some 420 miles off Madagascar. The span of these bridges was not great, being only a little over 122 ft., but the bridges had to be made sufficiently strong to resist the destructive hurricanes to which the island was subject, in some of which the wind reached a velocity of from 82 to 102 miles per hour.

Brunel submitted designs for these bridges, each bridge being divided into two roadways suspended by six chains $1\frac{3}{8}$ in. in diameter, with suspension rods of $1\frac{3}{4}$ in. diameter. His designs were accepted and a contract was signed in 1822. The work was to be executed in four months, and Brunel anticipated little difficulty in carrying this out, but his bad fortune followed him in this project also. Vexatious delays occurred, greatly adding to his difficulties and causing him to protest bitterly. He records in his journal on the 15th January, 1823, that "the cold was so intense that cast iron 15×10 ins. was broken." A good deal of the material supplied by the contractors proved defective, and it was not until towards the end of 1823 that the bridges were finally shipped to their destination.

Liquefied Gas as Motive Power

In 1823 Sir Humphrey Davy communicated to the Royal Society the results of Faraday's experiments showing that, by the combined application of high pressure and low temperature, certain gases could be liquefied. Brunel at once conceived the idea of utilising liquefied carbonic acid gas as a source of motive power, but after a great expenditure of time and money, and the overcoming of one mechanical difficulty after another, he had to admit that his scheme was impracticable.

NEXT MONTH:—

THE THAMES TUNNEL

The Story of Copper—(*cont. from p.* 75)

vats, pans, and strainers used in such industries. Copper pans are also largely used in sugar refineries for boiling purposes.

The applications of copper in the construction of scientific instruments, and in plumbing fixtures, are fairly well known and are far too numerous to mention. For many of these purposes there is no satisfactory substitute for copper.

Value for Domestic Utensils

Copper is particularly well adapted for the manufacture of domestic utensils. Articles of the most complicated forms can be produced by hammering or spinning, and the metal offers no difficulty in brazing. The slight danger of corrosion of copper owing to the possible absence of ordinary cleanliness is overcome by tinning the interior of the vessels. In addition to their long life, copper kitchen utensils result in a considerable saving of gas or other fuel on account of their high conductivity for heat. Large up-to-date bathrooms contain a considerable amount of copper in the form of hot water tanks, polished or plated water pipes and water taps. Copper is also largely used for ornamental purposes, the artistic appearance of beaten copper work being universally admired.

Copper has a special value for outdoor use on account of its freedom from anything more than surface corrosion, and no doubt it would be much more extensively used but for its high cost. It is particularly well adapted for the ornamental frontages of business places, doors, grills, etc., and for such purposes it affords the skilled workman more scope for artistic design than the commoner metals. Copper is also used to a small extent in this country and to a greater extent in the United States for the roofing of public buildings, and when these roofs have been exposed to the weather for some little time, their coat of verdigris gives a very pleasing effect.

NEXT MONTH:—

COPPER MINING

The Open Road—(*cont. from page* 83)

always be found useful in the cycle-shed at home.

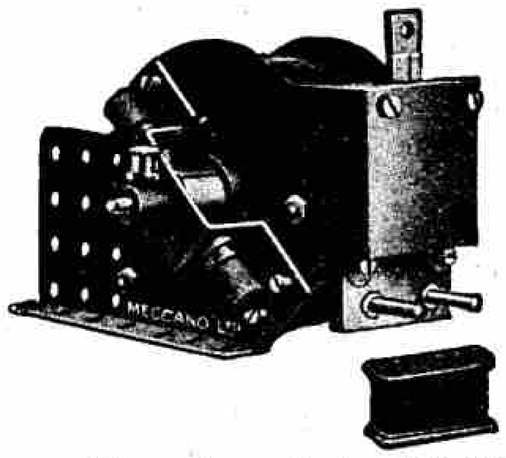
The Rear Lamp Question

Finally—and the subject has been left to the last so that its importance may be emphasised—every cyclist should carry a rear light. For some time past there have been heated arguments in the press as to the necessity of this precaution, but there is little hope of these discussions serving any useful purpose. Meanwhile, no sensible boy will risk unnecessarily his limbs and machine when, by fitting a red rear lamp or even an ordinary red glass reflector, he can make night riding safer, not only for himself, but also for all other road users.

NEXT MONTH:—

CYCLING TOURS AND ROAD MAPS

A New Meccano Motor



The above is an illustration of the 100/230-volt Meccano Electric Motor. It may be employed for any purpose for which a small motor is suitable, but it is specially adapted for running Meccano models. The side plates are perforated with standard equidistant holes, thus allowing the motor to be built into any Meccano model.

The motor is specially designed for connection with the electric light main, and is supplied for 100/120 volts or 200/230 volts (alternating or direct). It is fitted with a length of flex (6 feet), an insulated plug for connection with the motor terminals, and an adaptor for connection with an ordinary lamp socket.

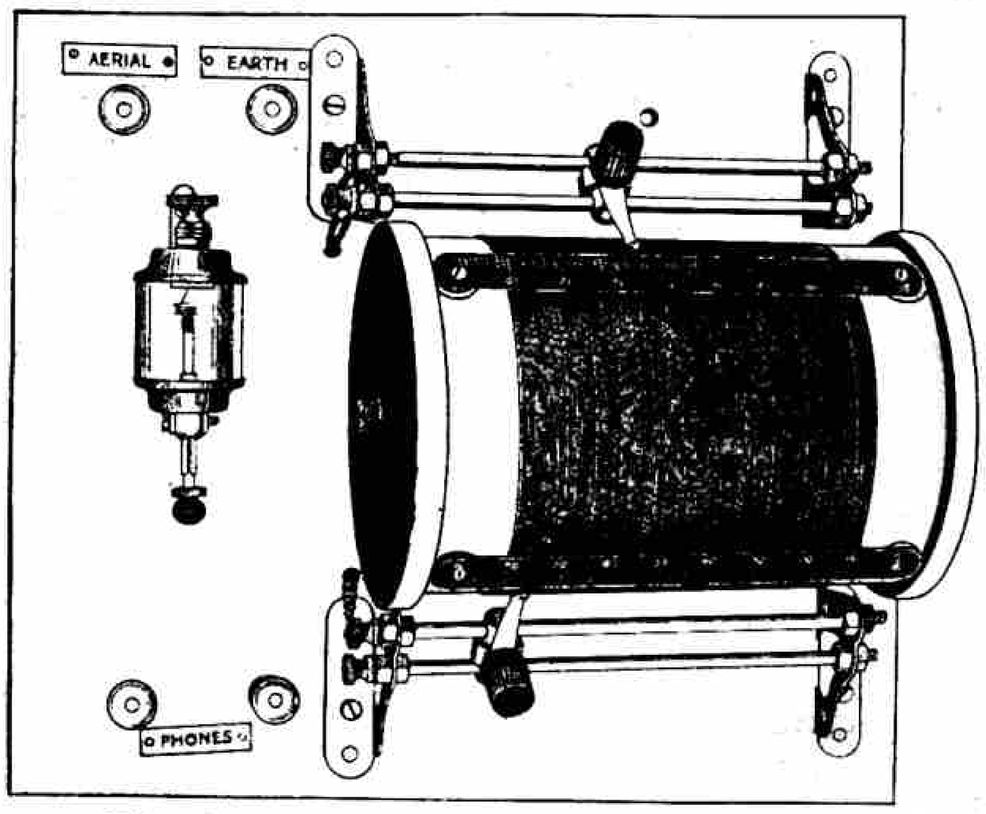
A suitable resistance is required when the motor is run with a 200/230-volt current. This is supplied by connecting a 60-watt lamp in series with the motor. A board, on which are mounted a suitable lamp holder (lamp not included), and a switch is provided separately.

100/230-volt Motor, price **32/6**

Lamp Board (with Lamp Holder and Switch) price **4/6**

FROM ANY MECCANO DEALER

LISTEN WITH MECCANO RECEIVER No. 1



The Meccano No. 1 Receiver is a highly efficient and splendidly finished instrument. The crystal detector is exceptionally sensitive and is enclosed in a glass chamber. Two slides are provided, one on each side of the inductance, giving greater selectivity and clearness of reception. Wave length: zero to 1,000 metres.

Dimensions of Set: $9\frac{3}{4}'' \times 8\frac{1}{4}'' \times 5''$.

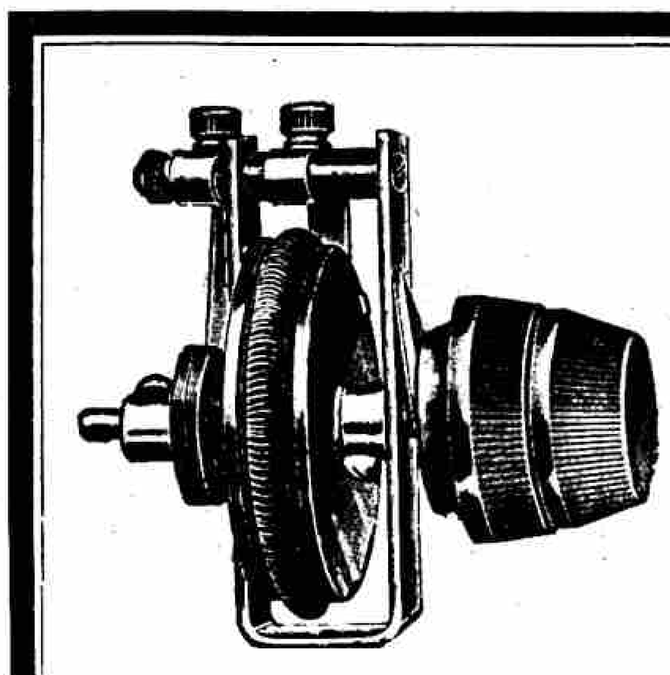
PRICE, post free (as illustrated), 15/9.

Meccano Ltd., Binns Road, Liverpool

IGRANIC
Filament Rheostat
(vernier type)
Pat. No. 195903

The perfect "control" for Dull Emitter Valves operated by 2-volt battery and Bright Emitter Valves with 4 or 6 volt battery. Supplied with 4, 6, 8 or 10 ohms resistance. Specially suitable for detector filament control and critical control of regeneration.

Price with fixing screws and drilling template for panel mounting, **7/–**





IGRANIC
Audio-Frequency Amplifying Transformer
Type E
Pat. No. 205013.

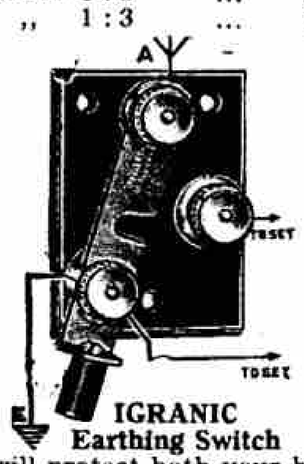
Noted for its distortionless reproduction of speech and music. The metal shroud effectively shields from external interference so that a number may be mounted closely for multi-stage amplification.

The impedence at speech frequency is suitable for most types of valves.

Made in ratios of 1 : 5 for first stage and 1 : 3 for subsequent stages.

Prices :

Ratio 1 : 5	...	21/–
,, 1 : 3	...	19/6



IGRANIC
Earthing Switch

will protect both your home and set. The terminals are of a patented improved type and carry the spring switch contacts which ensure perfect electrical conductivity. Mounted on solid ebonite base with three fixing holes. Price **3/–**



IGRANIC Vernob

For fitting to any rotary tuning device in order to obtain fine vernier adjustment. It is designed to fit ¼" spindles, but with a liner will fit 3/16" spindles. Price complete with liner and 180° scale ... **6/–**

Build a *better* radio set with

RADIO IGRANIC DEVICES

No wireless enthusiast can hope to secure the best results from 1925 broadcasting with apparatus of 1922 design.

If you would enjoy, to the fullest possible extent, the undoubted advantages of Radio Broadcasting, you *must* use components embodying the most up-to-date principles in design and construction.

The name IGRANIC represents the last word in *efficiency*, *quality*, and *reliability*. The design, workmanship and materials used in IGRANIC components are enabling thousands of wireless enthusiasts throughout the British Isles to build *better* radio receivers.

IGRANIC Radio Devices include :

Honeycomb Coils, Fixed Condensers, Variometers, Vario Couplers, Bi-plug Coil Holders, Tri-plug Coil Holders, Filament Rheostats, Battery Potentiometers, Intervalve Transformers, Vernier Friction Pencils, etc. *All carry a six months' guarantee.*

Obtainable of all reputable dealers.

Write for List No. Z374.

IGRANIC ELECTRIC COMPANY LIMITED

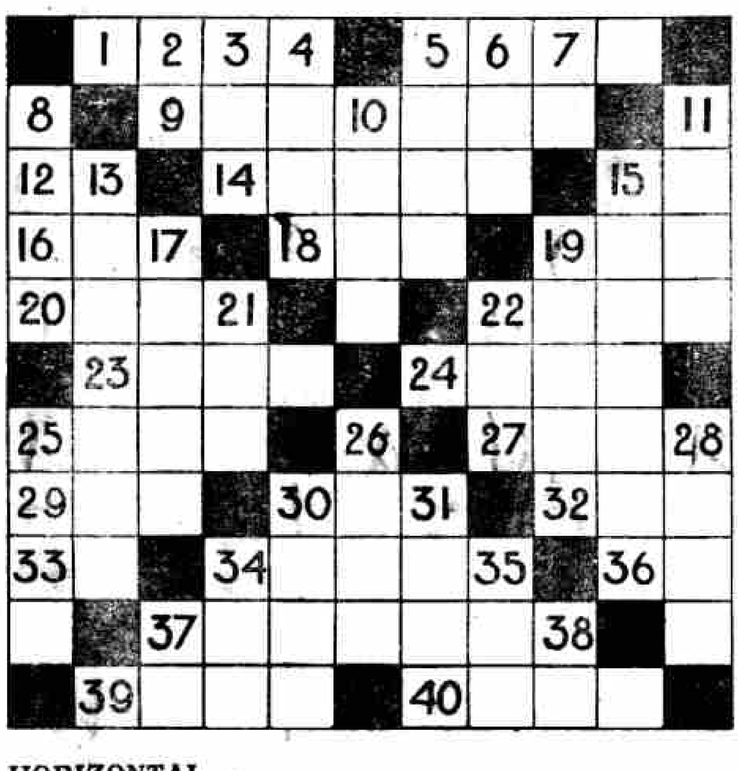
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Puzzle No. 60.



HORIZONTAL

1. Vehicles; 5. Extremity of a limb; 9. Inexhaustible source of fun; 12. Conjunction; 14. Linger; 15. Personal pronoun; 16. Purpose; 18. On the surface of cloth; 19. An animal; 20. Instrument of manual operation; 22. To weary; 23. Row; 24. Row; 25. Got up; 27. An animal; 29. To expel; 30. An ugly old woman; 32. A pen; 33. Pronoun; 34. Road well known to "*M.M.*" readers; 36. To such degree; 37. A cloth hanging; 39. Finished; 40. A weight.

VERTICAL

2. Part of verb "to be"; 3. Wager; 4. Examine; 5. Musical instrument; 6. Some; 7. Denial; 8. Vessel; 10. Measure; 11. Festival; 13. Tumultuous; 15. Selling places; 17. Damp; 19. Parts of a Skeleton; 21. Sheltered quarter; 22. Not nice; 25. To defeat utterly; 26. Deficiency; 28. Hindu cultivator of the soil; 30. Wages; 31. Insect; 34. Small sweet cake; 35. Word of respect; 37. Company; 38. Refusal.

Cross Word Puzzle Competition.

First Prize: Meccano Goods value £1 : 1 : 0
Second Prize: Meccano Goods value 10/6
Third Prize: Meccano Goods value 5/-

EVERY reader who wishes to enter for this competition must send in the solutions of the two Cross Word Puzzles, Nos. 60 and 61, together with a Cross Word Puzzle of his own invention.

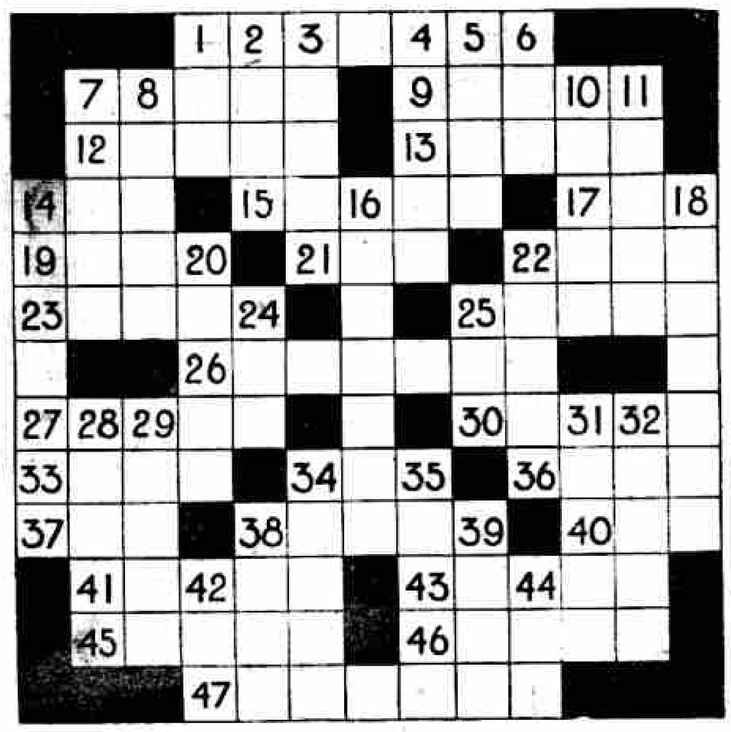
All puzzles submitted must be original and must not have been published previously. They must not contain Christian names, and if the names of any historical characters are used these must be thoroughly well known. Slang words must not be used, and all abbreviations employed must be specified as such unless they are in common every-day use.

The diagrams of Puzzles 60 and 61 are on much too small a scale for actual working. They should not be cut out of the page, therefore, but should be copied at least four times the size on to a sheet of paper. If an entry includes more than one sheet of paper, the name and address of the competitor must appear on each sheet.

For the information of new readers who may not be familiar with the method of working Cross Word Puzzles, we would point out that a specimen puzzle, fully explained and worked out, was given in last month's issue.

Entries for this competition must reach this office not later than 28th February.

Puzzle No. 61.



HORIZONTAL

1. Winding course; 7. Sudden panic; 9. Expel; 12. South American animal; 13. Warning on a chart; 14. A vaporous substance; 15. Polite; 17. A fish; 19. Ceremony; 21. A fish; 22. A document; 23. One who is proficient; 25. Part of the name of a well-known Scottish islet; 26. A navigable vessel; 27. Possession; 30. A bird; 33. To elate; 34. A fish; 36. Reputation; 37. Consume; 38. Key note; 40. Disease of sheep; 41. Hebrew stringed instrument; 43. Throughout; 45. Relating to a family of nations; 46. An ancient language; 47. To cheer.

VERTICAL

1. Describe clearly; 2. Blood fine in old Irish law; 3. House perched on a high place; 4. Method of cooking; 5. Wicked; 6. A frolic; 7. Grave; 8. Indicating social distinctions; 10. Variety of onion; 11. Things long and hanging; 14. To seize; 16. An account; 18. Cajoling talk; 20. An astronomical term; 22. A spur; 24. A bond; 25. To display; 28. A climbing plant; 29. Later; 31. Storage places; 32. An idol; 34. An Essex river; 35. A goddess; 38. A bird; 39. Fluid matter concreted; 42. Term in cricket; 44. Source of metals.

Puzzle No. 62.

A certain building erected many years ago was totally wrecked in a very bad storm. The contractors who were employed to re-build it were asked to retain in its place the original foundation stone which bore the date of erection. They carried out this request, but unfortunately they laid the stone upside down, yet nobody noticed the mistake. What was the date on the stone?

* * * *

Puzzle No. 63.

A printer had an order for 10,000 Bill Forms per month to be printed with the name of the current month. Thus he printed 10,000 forms with the word January, 10,000 with the word February, and so on. The particular types to be used for printing the names of the months were expensive and he therefore purchased only just enough to enable him to print the whole of the months of the year, using capitals throughout. How many separate types did he purchase?

* * * *

Puzzle No. 64.

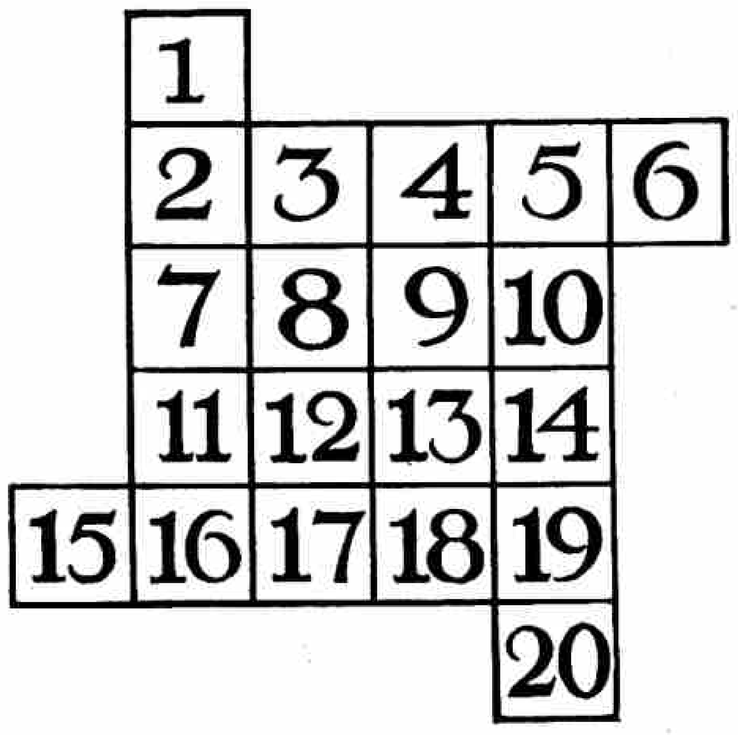
A certain number consists of two figures. Add these two figures together and multiply the result by itself and the result is the same two figures but in reverse order. What is the number?

* * * *

Puzzle No. 65.

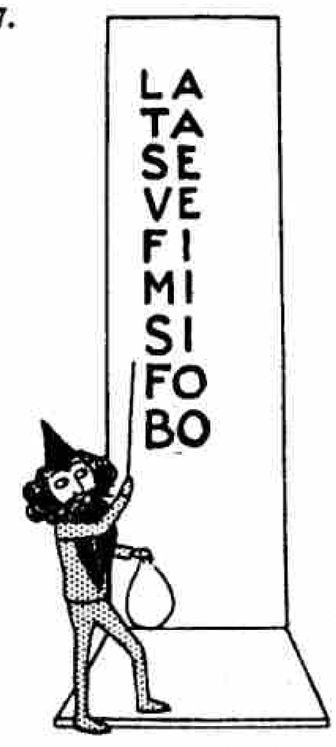
Three boys robbed an orchard and put all the apples in a bag. The first boy divided the apples into three parts, and as there was one over he threw it away. He then took one part and put the remaining two parts back in the bag. The second boy also divided the apples into three parts, threw the odd one away, took one part and put two parts back. The third boy did the same. Then all three divided the remaining apples into three parts, took one part each and still threw the odd one over away. How many apples were there to begin with?

Puzzle No. 66.



Twenty men were imprisoned in a fortress containing twenty cells as in the plan below. There were four British, four French, four German, four Russian and four Italian prisoners. They were so placed that none had one of his own countrymen in an adjoining cell. How was this done?

Puzzle No. 67.

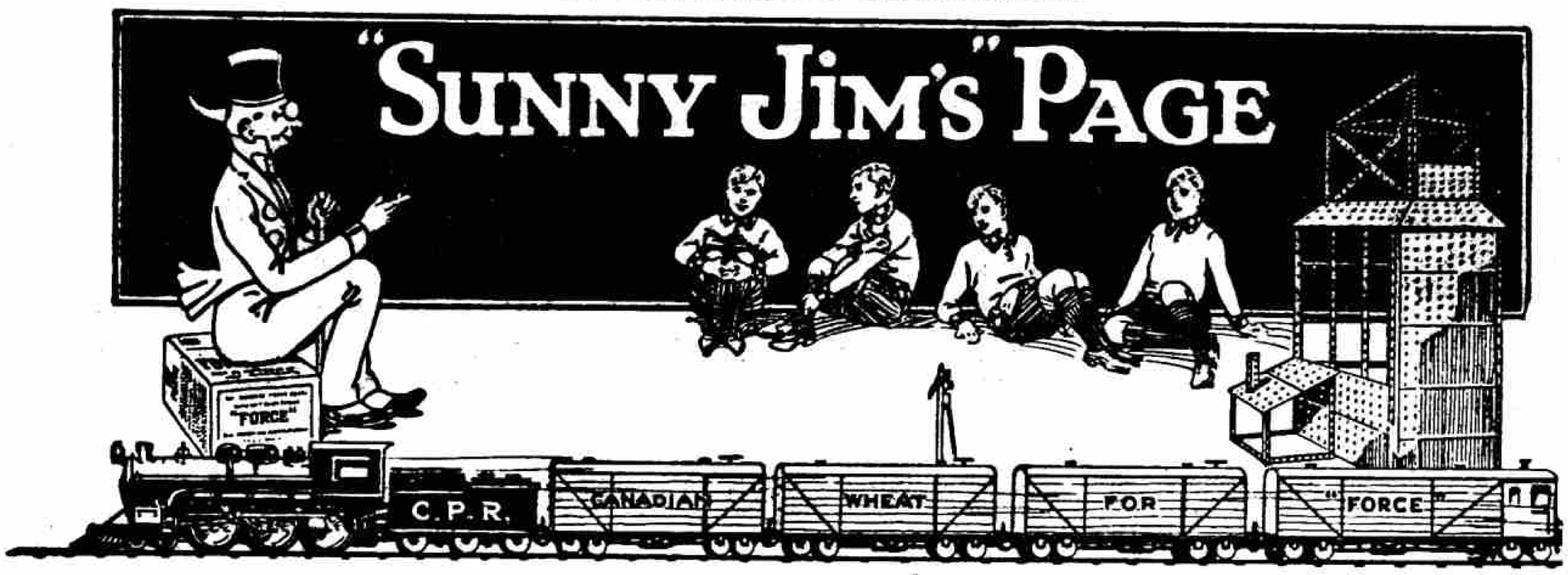


The little man shown in this picture has the whole alphabet in his bag. What one letter must he take from it to complete the nine syllables shown in the picture?

* * * *

Puzzle No. 68.

The initials and finals, spelt downwards, of the seven words indicated by the following definitions give the names of two vegetables:—1. To summon; 2. Not asleep; 3. A useful fastener; 4. A stain; 5. A son of Aaron; 6. A vegetable; 7. Appreciated after toil.





Did you notice it?

In last month's cross-word puzzle on this page there was a "*printer's error!*" There! I've said it now. You see it's always safe to blame Mr. Printer because he can't answer back. Your Editor says the fault was mine—in fact he wrote to tell me about it. When I read his letter I went hot and cold all over. I had visions of thousands of Meccano boys working day and night trying to solve a pesty cross word puzzle that just would not come right, simply because it was wrong. When I asked my chief assistant, he said it was the office boy's fault. The office boy said he'd never seen the puzzle before, so it was no use blaming him. Then I was struck with a bright idea! Call it a "printer's error!" Ha! that sounded better. So a "printer's error" it is.

"What is the error," did you ask? Well, somehow or other a silly figure 2 pushed its way into the space that was really reserved for figure 4 in the "Horizontal" column of the clues. The correct solution to the puzzle is as follows:–

HORIZONTAL.

1. Hits. 4. Maj. 7. How. 9. Sis. 11. Go. 12. Ha! 13. Mud. 15. FORCE. 17. No. 18. Lo. 19. Oar. 20. Inn. 21. Adult. 22. Boy. 23. Bon. 24. Eve. 25. Tease.

VERTICAL.

1. Ho. 2. Thor. 3. So. 5. As. 6. Jim. 8. Wheat. 10. Sunny. 11. Good. 14. Don. 15. Flake. 16. Cold. 20. Ions. 22. Boa. 23. Be.

THANKS!

I want to thank all those boys and girls who found the mistake and corrected it for me. They may be interested to hear that there were hundreds who did not see it, or if they did, said nothing about it when they sent in their solutions.

MY PICTURE.

Now I suppose you are wondering why I have published such a large picture of myself on my "page" this month! The picture, as you will see, shews two Meccano Boys with whom I stayed recently, getting up on a cold morning to have their "FORCE" breakfast. You should have seen them eating "FORCE" with hot milk! One said that he had never tasted anything he liked better in all his life, and the other said something that sounded like "scrumptious," but he was too busy eating "FORCE" for me to hear clearly what he really did say. It was certainly something nice about "FORCE!"

ARE YOUR EYES GOOD?

This picture is more than an ordinary picture, however, because I have specially asked the artist to leave out parts of his drawing so that you Meccano boys can amuse yourselves by discovering the missing parts. It is a good test for keen eyesight, and I specially expect to receive solutions from you boys who failed to notice the "*printer's error*" which appeared in last month's number. Send your solutions to me at my office, Dept. Mc.5, 197, Gt. Portland St., London, W.1., and I will send you a free sample of "FORCE," provided, of course, that you have not had a sample before. You are sure to like "FORCE," and here is an excellent opportunity for you to show mother what lovely food it is for either breakfast or supper. If you like, you can eat "FORCE" with stewed fruit.

Remember that "FORCE" is the whole of the wheat malted for easy digestion and ready cooked and toasted for delicious flavour. Ask mother to serve it for you whenever you like. Take my tip, boys, and get going on "FORCE" *every* morning of the week. It does you good.

Yours forcefully,

Sunny Jim



Fireside Fun

THE introduction of Cross Word Puzzles has met with quite a chorus of approval from our readers, and entries for last month's contest have come in in very large numbers. Many of the original puzzles submitted were very ingenious, but others showed that the competitors had not fully grasped the method of working. One of the most common defects was that of giving bad definitions. Although it is perfectly legitimate to give as a definition an uncommon meaning of a word, at the same time the definition must be such that careful thought should lead to the discovery of the word. Some of the definitions I have examined were absolutely wrong, and I advise those who intend to take part in future Cross Word Puzzle Competitions to consult a dictionary whenever they have any doubt as to the real meaning of any unusual word they use in their own puzzles.

I must also draw attention to the necessity for competitors to write their names and addresses on every sheet of paper included in their entries. In many cases the name and address appeared only on the first sheet of paper, and when the other sheets got separated from this—as is always liable to happen when large numbers of entries are being dealt with—the Puzzle Editor had to put himself to an enormous amount of extra trouble in order to try to connect the pages together by comparing the hand-writing. I hope competitors will remember this point in future.

This month I am offering prizes for another Cross Word Puzzle Competition, and I hope to receive a large number of entries. Full particulars will be found on the Puzzle Page.

* * * *



First Boy: "My father's a doctor, so that I can be ill for nothing."

Second Boy: "That's nothing to swank about; my father's a parson, so I can be good for nothing!"

* * * *

Q. Why would a sparrow be angry if you called him a pheasant?

A. Because you would be making game of him.

This Month's Short Story

Felix walking
On the rail,
Came a train,
Lost his tail.

* * * *

Isaacs: "My son gets 3d. a day for his pocket money."

Jacobs: "3d. a day, and only six years old?"

Isaacs: "Yes, but you see he puts the money into the gas meter, he thinks it is a money box!"

* * * *

SAFETY FIRST!

Anxious customer: "Are you a chemist and druggist?"

Chemist: "Yes."

A.C.: "Have you been in business for a number of years?"

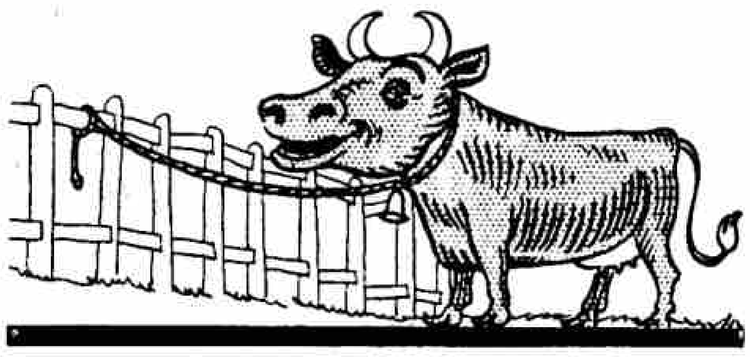
Chemist: "Yes."

A.C.: "Is that your diploma hanging there?"

Chemist: "Yes."

A.C.: "Then give me threepennyworth of tooth powder!"

* * * *



Teacher: "Tommy, give me a sentence containing a conjunction."

Tommy (after prolonged thought): "The cow is tied to the fence with a rope."

Teacher: "Well, where's the conjunction?"

Tommy: "'Rope.' It connects the cow to the fence."

* * * *

Q. Which is the most learned county in England?

A. Berkshire, because a large town in it is always Reading.

* * * *

Q. How many feet have 40 sheep, a shepherd, and his dog?

A. Two. Sheep have trotters and the dog has paws.

* * * *

Q. What is it that is taken from you before you get it?

A. Your portrait.

* * * *

Q. Why does a railway official punch a hole in your ticket?

A. To let you go through.

Answers to Last Month's Puzzles

No. 54.

A	T	O	N	E	■	S	H	U	N	S
L	O	R	E	■	■	E	P	I	C	
O	R	■	T	A	M	E	R	■	L	O
E	E	L	■	R	A	M	■	H	E	N
S	■	O	R	E	■	U	S	A	■	E
■	■	D	O	■	■	P	I	■	■	
B	■	G	A	S	■	R	O	T	■	A
A	M	E	R	I	C	A	N	I	S	M
N	O	■	I	R	O	N	S	■	H	E
D	O	■	N	■	■	O	■	A	N	
S	N	A	G	S	■	T	R	A	M	S

* * * *

No. 55.

16	3	2	13
5	10	11	8
9	6	7	12
4	15	14	1

* * * *

No. 56.

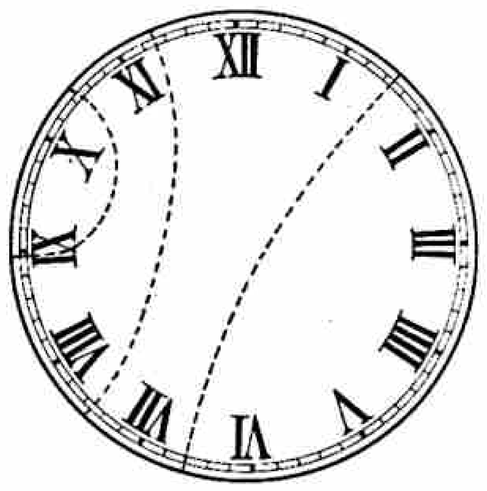
1. Draw-bar.
2. Guard-iron.
3. Smoke-box.
4. Sand-pipe.
5. Fire-door.
6. Cab-roof.
7. Spark-arrester.
8. Tender-coupling.
9. Ash pan.
10. Footboard.
11. Handrail.
12. Headlight.

* * * *

No. 57. Habit—Abit—Bit—It—T.

* * * *

No. 58. Where the cracks came:—



* * * *

No. 59. A map of the world.

Teacher (to scholars): "I will give a crown to any one of you who can ask me a question that I cannot answer."

Georgie: "Please teacher, why am I like the Prince of Wales?"

Teacher: "I am afraid that beats me, Georgie, what is the answer?"

Georgie: "Please teacher, because I am waiting for the crown."

Georgie got his money!

JAEGER
Pure Wool

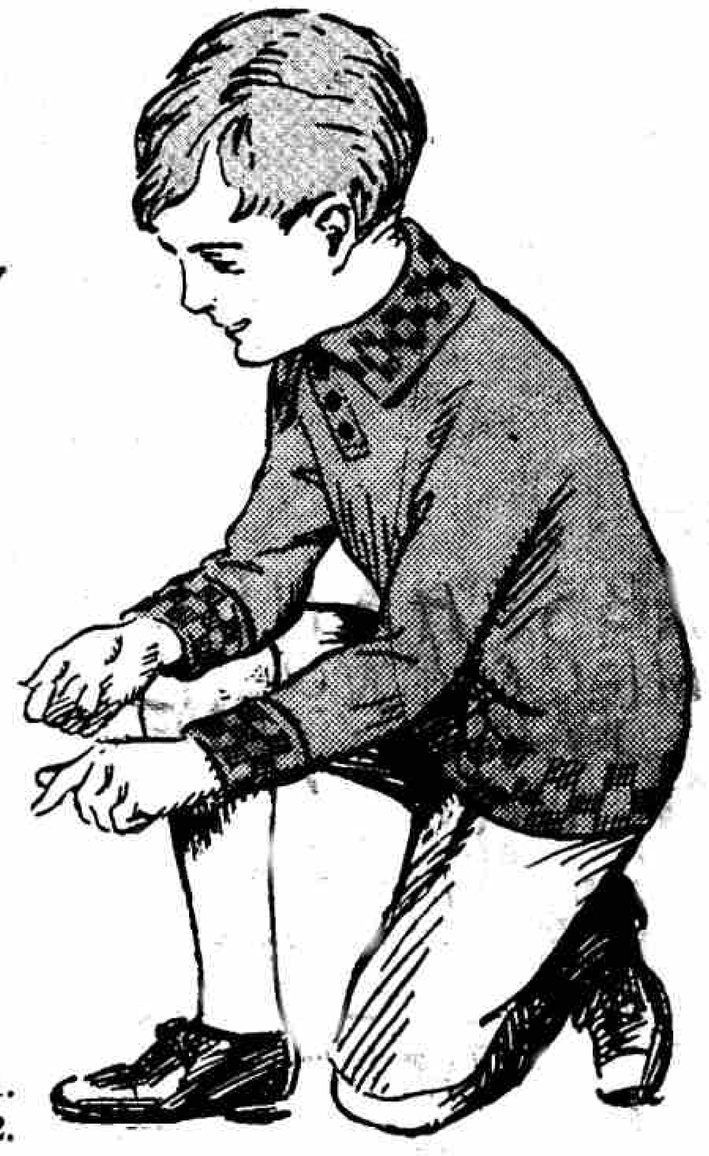
The New "Meccano" Jersey

A Jaeger "Meccano" Jersey is made in the special "Meccano" pattern. It wears splendidly and prevents the frequent chill a boy gets when hot, as every boy will sooner or later. The "Meccano" Jersey appeals to every boy at once as well as to the "grown-ups" who study the health and happiness of their children.

24″	26″	28″	30″ Chest
8/3	9/-	9/9	10/6

Light Fawn/Brown, Navy/Saxe,
French Grey/Mole, Mid Grey/White.
Brown/Light Fawn

Obtainable only from Jaeger Depots and Agents.
Write for the address of your local agent.



JAEGER HEAD RETAIL DEPOT: 352,54, OXFORD ST., LONDON, W. 1.
WHOLESALE & SHIPPING: 95, MILTON ST., LONDON, E.C. 2.

A PROFITABLE HOBBY

IS THE USE OF

SECCOTINE

(Regd. Trade Mark)

MAKES OR MENDS THINGS INNUMERABLE

CHAIRS, TABLES, BEDS, PICTURE FRAMES

INVALUABLE FOR

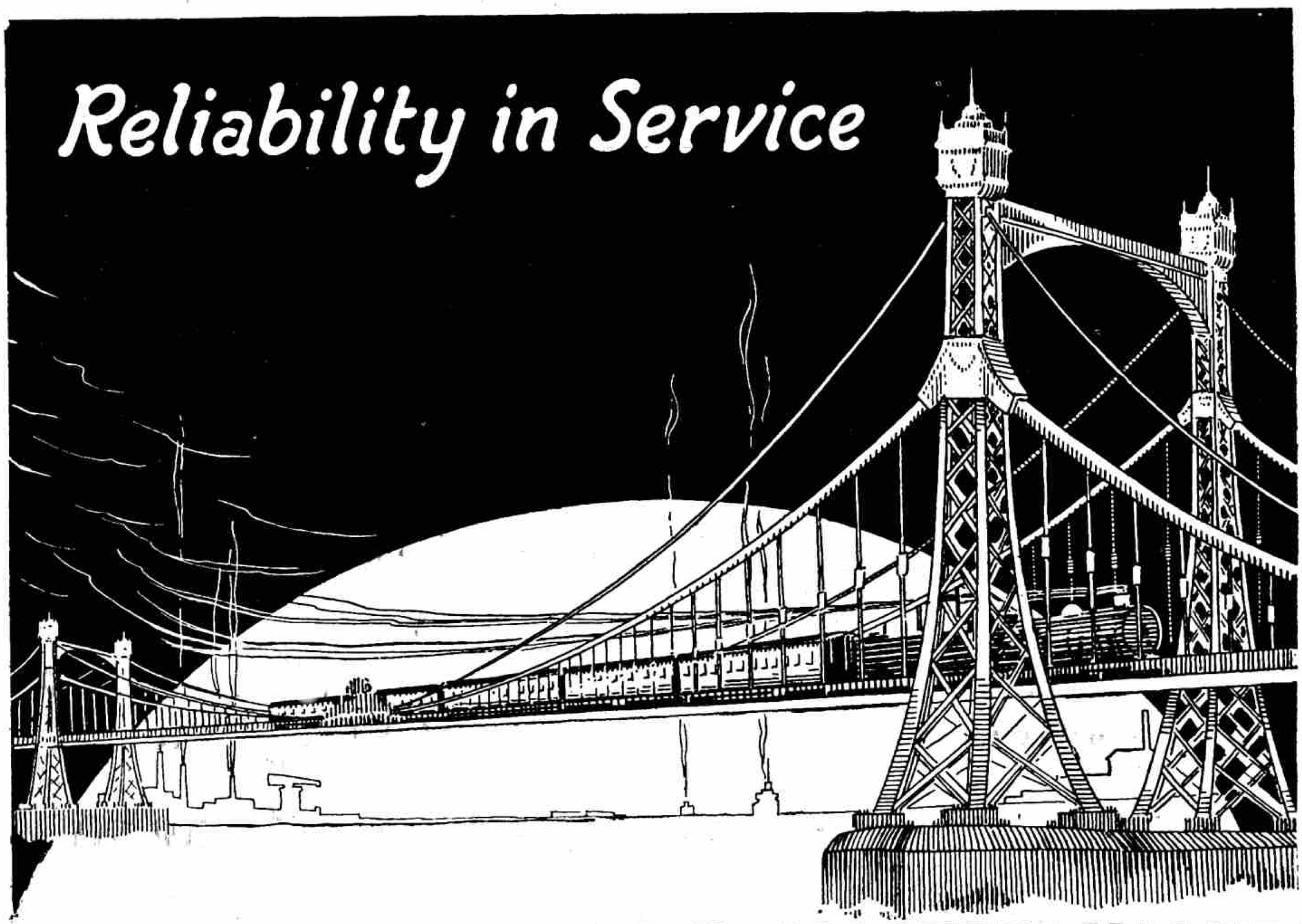
Photo-mounting — Model Making — Bookbinding — Mounting of Natural History Specimens — Renovation of Silk, Linen, Lace, &c., &c.

SOLD ALL OVER THE WORLD, pin-stopper tubes, 4½d., 6d. and 9d. each.

USE FIRMAS (Heat Seccotine) for articles required to hold liquids—hot or cold—Tubes 6d. each.

M'CAW, STEVENSON & ORR LTD., BELFAST

Write for a free booklet about Scccotine.



MULLARD H.F. and L.F. MASTER VALVES

are acknowledged to be the finest MODERN RADIO ENGINEERING ACHIEVEMENT in wireless receiving valves ever produced for the radio public.

Their whole construction is one of giant strength and supreme efficiency in operation.

You have not achieved the most perfect reception from your wireless set if you have not tried these MULLARD MASTER VALVES.

Demand Mullard H.F. Red Ring Valves for H.F. AMPLIFICATION OR DETECTION, **12/6** each.

Mullard L.F. Green Ring Valves for L.F. AMPLIFICATION, **12/6** each.

Mullard H.F. and L.F. Valves for dull filament operation can also be obtained.

Ask your dealer for leaflet M.8 and avoid accidents to your valves by using the Mullard Safety Disc, free on request. If you cannot get what you want, send us your dealer's name and address, and we will supply his requirements.

Mullard

THE·MASTER·VALVE

Advt.—The Mullard Radio Valve Co. Ltd. (M.M.), Nightingale Works, Nightingale Lane, Balham, S.W. 12.

BRITISH MADE **LOTT'S BRICKS** BRITISH MADE

OF ARTIFICIAL STONE

WILL MAKE YOUR MODEL RAILWAY MORE REALISTIC.

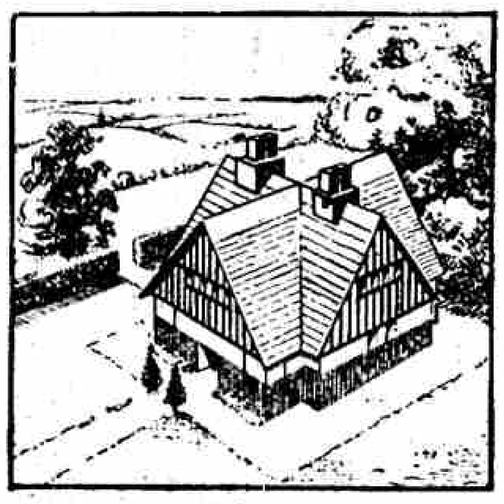
Model from Box B. Series B. Price 5/6



Boathouse.
Complete with Bricks, Roof, White Paling Fences, Trees, and designs for 12 Models.

Some Provincial Specialists in our Building Bricks :
Wylie Hill & Co. Ltd., Glasgow.
Jenner & Co. Ltd., Edinburgh.
H. Wiles Ltd., Manchester.
Townsend & Co., Littlehampton.
Alfreds, Newcastle-on-Tyne.
H. D. Simmonds, Clacton-on-Sea.
F. Thornley, New Mills, Stockport.
Pickford, A. & L., Eltham, Kent.
Wrights, Erdington, Birmingham.

Some Examples of what can be done with this delightful Constructional Toy. Write for complete Illustrated List, and name of your nearest Agent.



Four-Gabled House.

Model from Box 2. Tudor Blocks. Price 7/6

Box 2. Bricks, Roofs and designs for 12 Models. Plans are enclosed for larger models using Boxes 1 and 2 in combination.



Village Hall.
Containing 18 original designs and Bricks with Thatched and other Roofs. Packed in well-made wooden box with lift-out tray containing Trees and Fences.

Model from Box 3. Tudor Blocks Price 17/6

Benetfink & Co. Ltd., Cheapside, E.C.
J. Barker & Co. Ltd., Kensington.
A. W. Gamage Ltd., Holborn, E.C.
Harrods Ltd., Brompton, S.W.
Hamleys Ltd., Regent Street, W.
Hamleys Ltd., High Holborn.
Jones Bros., Holloway, N.
Selfridge & Co. Ltd., Oxford St., W.
The Pygmalion, Leeds.

LOTT'S BRICKS LTD., WATFORD, England



FREE

Blue Print given away with this issue.

MAKE SURE OF YOUR COPY

Choose Your Set

from the wide range of wireless receivers—crystal to super-valve sets —which are clearly described and fully illustrated in this and previous issues of the WIRELESS CONSTRUCTOR. Make one in your own home. It is the cheapest and most efficient method of getting a set, which, when instructions are followed, will give you guaranteed results.

There is no need for expensive tools or a special knowledge of wireless, as all instructions given are clear and concise. Photos, drawings and diagrams explain everything.

6D. MONTHLY — **The Wireless Constructor** — **6D. MONTHLY**

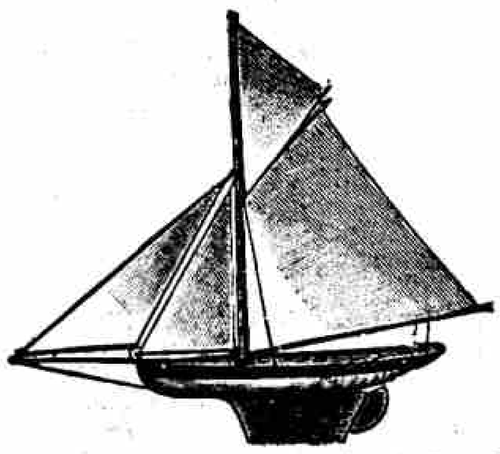
This issue of the WIRELESS CONSTRUCTOR has been enlarged to no less than 108 pages ; full of interesting and instructive articles, suitable for the absolute beginner, the crystal or valve user, as well as numerous other articles and much useful information for those who, at the moment, are only interested in receiving their local station.

The WIRELESS CONSTRUCTOR, published monthly at 6d., is by far the most popular wireless magazine in existence. Start NOW by getting this February issue, and at the same time also order the three previous issues. Obtainable from local newsagents, booksellers, bookstalls, wireless dealers, or 8/3 per annum, post free, from : Radio Press Ltd., Bush House, Strand, London, W.C.2.

Advt. of The Radio Press Ltd.. Bush House, Strand, London, W.C.2. The Largest Wireless Publishers in the world.

Barclays, 1214

KENSINGTON MODEL DOCKYARD



Sailing Yachts and Fittings

MOTOR & STEAM LAUNCHES
ELECTRIC & MECHANICAL TOYS
CINEMATOGRAPHS CAMERAS
INDOOR GAMES CUTLERY & TOOLS
OUTDOOR SPORTS FRET OUTFITS
AIR GUNS FISHING TACKLE
HORNBY TRAINS
MECCANO OUTFITS & PARTS
Always in Stock.

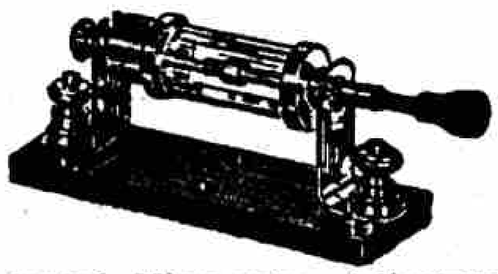
Send 1½d. Stamp for List "M."

C. H. LORBERG
185, Kensington High St., London, W.8.

Use a SERVICE Detector

and get the maximum amount of satisfaction.

Crystal replaced in a few seconds, NO SOLDER BEING REQUIRED. Not affected by vibration.



Patented Micrometer Adjustment
(Prov. Pat. No. 15224/24).

Glass enclosed and dustproof. Spring for holding crystal in place. Highly polished nickel-plated or gold lacquered finish. Undoubtedly finest value obtainable.

Obtainable at all Wireless Stores.

Price **2/9.** *For Panel Mounting* **2/6.**

SERVICE RADIO CO. LTD.,
67, Church Street, Stoke Newington.
LONDON, N.16.

THE
PRACTICAL ELECTRICIAN'S POCKET-BOOK——1925
is the best practical book for all interested in electrical work.
570 pages
for 3s. 4d. post free.

S. RENTELL & CO. LTD.
86, MAIDEN LANE LONDON, W.C.2
Specialists in books or the City and Guilds
Ask for catalogues.



MODEL WITH HARBUTT'S PLASTICINE

10 Colours - Clean in Use - Ever Plastic

Sample Rainbow Box with 6 Colours, 9d., or Post Free 1/-

Write Us for Illustrated Circulars:

HARBUTT'S PLASTICINE LTD.
99, BATHAMPTON, BATH

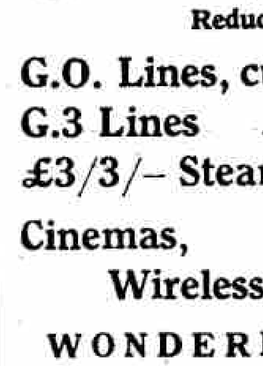
BOYS!
Now's your chance

We are selling New Goods at Reduced Prices

Write for list—post free.

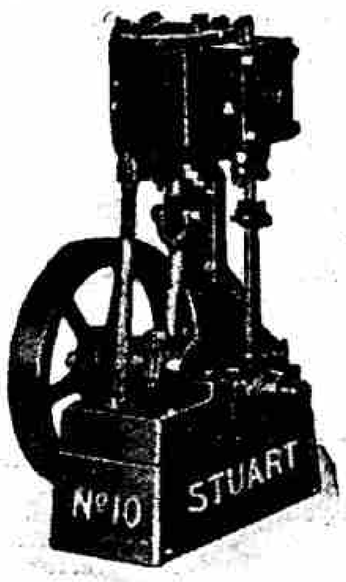
6/– Boys' Books ... each 4/–
30/– Traction Engines each 10/–
Model Railway Goods (Not Meccano)
Reduced 3d. in the 1/-
G.O. Lines, curved only, each 1½d.
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£3/3/– Steam Locos £2/–/–
Cinemas, Films, Tools.
Wireless Goods and Sets.
WONDERFUL BARGAINS.
Postage extra.

C. LUCAS, Hobbies Depots,
35, MANCHESTER STREET,
LIVERPOOL.



YOU
can build a £40 Gramophone with our Scale Drawings and Fittings for 40/-. Our Large Illustrated Catalogue of Gramophones, Motors and Tonearms, etc. will interest you. Post Free 2d.
Harmony Gramophone Co.,
366. York Rd., London, S.W.1

TURNYTOVER
The Game that is different.
HELMET POOL. The new all season game for all ages. Mr. TURNYTOVER and 12 coloured Metal Helmets in tin box.
Post Paid 2/-. AGENTS WANTED.
Makers:
FORGE & CO., Eastham Ferry, Cheshire.



Stuart Engines

You can build with just a few hand tools.

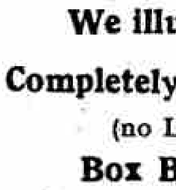
Send a stamp for List No. 12M —better still, send 6d. for the Complete Stuart 80 page Catalogue.

We illustrate the Stuart No. 10.

Completely Machined Parts (no Lathe required) **21/-** Post Free
Box Bed 2/6 extra.
Engines from 5/–. Boilers 8/–.

Stuart Turner Ltd.
HENLEY-ON-THAMES

Wireless Cabinets YOU Want



PICKETT'S Cabinets—they're good value, from 1/6 each, highly polished.
Write for Constructor's List Free.
Cabinet (M.C.) Works, Albion Rd. Bexley Heath, S.E.

HAVE YOU HAD A COPY OF OUR 1925 CATALOGUE?
IT'S FREE.
Contains an interesting selection of Lighting Sets from 2/6, Electric Motors from 3/3, Dynamos from 4/6, and hundreds of Electrical Novelties of 1925. SEND NOW FOR A COPY.
Note New Address:
A. W. NORTH, 6, High Street, Petersfield, Hants.

MAKE YOUR OWN ELECTRIC LIGHT



These wonderful dynamos light brilliantly 4–6 volt lamps, and are very easy to work ... 5/–
"DE LUXE" model, larger, and giving approx. three times output, wonderful value 10/–
"SUPER DE LUXE" model, larger still, giving approx. five times output ... 15/-
All Post and Packing Free. Send for FREE Lists.
GREENS (Dept. A.N.), 85, New Oxford Street, LONDON.

Meccano boys win cash prizes. See page 104.



Readers' Sales & Wants



If you have anything to sell or wish to buy anything take advantage of the service offered by a small advertisement in these columns.

The "*M.M.*" is read by approximately 100,000 people every month. It circulates in every country where the English language is spoken. If you wish to sell your duplicate stamps, your rabbits, or your tools, or to purchase a loud speaker, a steam engine, a model yacht, or a hundred-and-one other things, you will be able to do so through the columns of the "*M.M.*"

The rates are one penny per word, with a minimum of 1/- (cash with order).

Your advertisement must be received before the 10th of the month for insertion in the following month's issue.

If a Box Number is used, 4d. should be added to cover the cost of postage of the letters to the advertiser from this office. The letters will be posted one week after the advertisement appears, and a second batch a month after the advertisement appears. They will be sent more frequently if additional postage is included with the advertisement.

IMPORTANT.—Advertisements dealing with any article in the Meccano catalogue cannot be accepted.

PLEASED ADVERTISERS

We are getting far more enquiries than is usually the case. N. & Co.

I find your periodical very satisfactory. W.D.Ltd.

The business resulting from the February advertisement was so good that I had to miss your March issue—in fact, replies are still coming in. E.W.P.

I am satisfied with the results of my previous advertisement. H.J.H.

The small space we had with you brought in a fair number of replies. H.P.Ltd.

From my second advertisement in your paper I obtained about one hundred and twenty replies—including thirty-two from abroad. I shall have no hesitation in coming to you again next season. S.H.C.

We have received quite a number of orders for our apparatus this morning as a result of your advertisement. P. & T.Ltd.

I am a confirmed advertiser now in the "*M.M.*" and so far have had very satisfactory results. A.W.N.

We have no hesitation in asserting that our clients are convinced that your Magazine is one of the best pullers in which they advertise. B.D. & Co. Ltd.

We know from the results attained by our advertising in your Journal that your readers are most keenly interested in our goods. A.R.

I had great success with the last advertisement I inserted in your columns. L.F.

Recent advertisements in the "*M.M.*" have brought us satisfactory results, both numerically and in regard to the class of readers replying. S.G.Ltd.

We really are getting splendid results. F.Co.

I do not doubt for one moment that ½" in your paper equals ½ page in many purely philatelic journals. S.H.C.

My insertion in your November number produced very satisfactory results. E.C.C.

Owing to the great number of replies in consequence of my advert. in November I was unable to advertise in December number. Yours is undoubtedly the finest advertising medium I have ever tried. P.J.D.

We regret to say that we shall be absolutely unable to take space in your February issue owing to the fact that we have had a really enormous number of replies from our Christmas insertion. These are still coming in. To be quite frank we did not really expect so many, and in consequence are slightly disorganised. A. & W.

A 2/- advertisement, three months ago, produced so many replies, and repeat orders, that I was unable to deal with them all. I am still supplying collectors with fresh selections every fortnight, and they are regular buyers. J.B.

READERS' SALES

(Rate: 1d. per word, min. 1/-).

B.S.A. Rear Cycle Wheel, complete with free wheel, practically new, £1.—J. Dorey, Salway Ash, near Bridport, Dorset.

Will sell my fine Valve Wireless Instrument for 32/-, post free, fine condition, worth treble.—Waine Compton, Wolverhampton.

For sale, 250 ft. film, The Gaumont Graphic, what offers. Also small Pocket Telescope, 1/6.—Write first. B. Loveland, Gordon Villa, Mayburn Hill, Woking.

"Meccano Magazines" for sale. Absolutely clean. Numbers 2-35, 6d. each (old issues). Numbers July 1923–June 1924, 1/- the lot. Total 18/-.—Smith, 20, Greenbank Road, B'head, Ches. Postage paid.

Wanted—Meccano Tension Dynometer (47), disc weights (49) of 1914 lists, also No. 1 Manuals, 1900 to 1912, 1915, 1916, 1917, 1918, and No. 2 1918, all English editions.—James Saddler, Myall Avenue, Kensington Gardens, Adelaide, South Australia.

Ten-Shilling Combined Cinema Magic Lantern, 300 ft. standard film, slides. Lot 6/-. Three home-bound volumes "Scout," good condition, 9/-.—Evans, 19, Uphill Park, Weston-s-Mare.

Will anyone exchange George V. Set, good order, for 2 dynamos, 4-volts, nearly new.—Bowdrey, 78, Bridge Road, Uxbridge.

Bassett-Lowke Steam Locomotive, 4-4-0, Gauge 0. Beautiful model, cost £6/6/-, 1923. In excellent condition. £3 or near offer.—Jefferson, Pyrford Woking, Surrey.

Open Wagons, Gauge 0 (1¼"), 1 L.N.W. and 1 M.R. Tinplate—Bassett-Lowke), 3/3 each, post free.—Fuller, Wandsworth Road, Station Cottage, Clapham.

For Sale. High-class Steam Locomotive and Tender. Length 13 inches. Perfect condition. Cost 28/6. Bargain for 15/-.—Baxter, Castletown, I.O.M.

Back Numbers "Meccano Magazine," 11, 12, 15 to date. Offers to—Brake, Tansley, Matlock.

SMALL ADVERTISEMENTS

(Rate: 1/- per line).

Patents, Advice, Handbook and Consultations Free. B. T. King, C.I.M.E., Regd. Patent Agent, 146a, Queen Victoria Street, London, E.C.4. 38 years' reference.

EDISON 4 minute Blue Amberol Phonograph Records, reduced prices. New goods now arriving. Lists.—A. Robinson, 333, Hainton Avenue, Grimsby.

Gent.'s Strong Nickel Keyless Watch, 4/11 each, post paid. (Worth double).—G. Banks, Drub Lane, Gomersal, Leeds.

LIVING STICK INSECTS from East Indies and Mesopotamia. Very curious. Perfectly harmless. From 1/6 doz; Eggs 8d. doz. British and Exotic Living Pupae, Aquarium Fish, etc., Lists Stamp. Silkworms' Eggs, 1/- 100. Rare Exotic Living Arachnida.—Rose, Alexandra Road, Tonbridge.

Toy Soldiers. Make your own. Moulds hired, 1/6 week.—Kearley, 142, Purvis Road, Willesden.

Gent.'s 9-Carat Gold Watches, 15 Jewel Lever-Movement, £5 10s. 0d., post paid. **Guaranteed.**—Banks, Drub Lane, Gomersal, Leeds.

CINEMA FILMS.

SALE—HIRE—EXCHANGE, also Machines, Re-winders and Accessories. Good Sample Film, 1/- Post Paid.

LISTS FREE.

Filmeries, 57, Lancaster Rd., Leystonstone, London, E.11

CINEMA FILMS, 100 ft. 1/-, 1,000 ft. 6/-, delivered.—Phillips, 64, Ewart Street, Brighton.

LOOK BOYS! Comic Films 2/- each, post free. World Film Exporters.—Photoplays, Pinden, near Dartford.

Cinematograph Films Cheap. Sale-Hire-Exchange. 100 ft. sample 10d. Projectors and Accessories.—Don Cinematograph Supply, 96, High Street, Penge, S.E.

Home Cinematographs. Great Clearance Sale. Your opportunity to secure large Cinema or Films cheap. Lists Free.—Pictures, 109, Kenlor Road, Tooting.

ENORMOUS STOCK OF CINEMA FILMS FOR SALE. 1 reel dramas only, in good condition. 8/6 each, post free. No lists. Order early.—G. Hare, 36, Willes Road, Leamington.

CINEMATOGRAPH FILMS, Machines, Accessories, Bargains. 100 ft. Film and List 1/-.—Tottenham Film Exchange. Offices, 2, Ascot Rd., S. Tottenham, N.15.

CINEMA FILMS, MACHINES, ACCESSORIES, 100ft. film and lists, 1/-. Stamp brings Wireless Lists.—J. Humphreys, 40, Davenant Road, London, N.19.

Home Cinema Machines, Films. Bargain Lists free.—Universal, 112, Newington Causeway, S.E.1.

MECCANO MAGAZINE

Registered at G.P.O., Lo transmission by Canadian Post.

EDITORIAL AND ADVERTISING OFFICES:—

BINNS ROAD, LIVERPOOL.

Telegrams: "Meccano, Liverpool."

Publication Date. The "*M.M.*" is published on the 1st of each month and may be ordered from any Meccano dealer, or from any bookstall or newsagent, price 3d. per copy. It will be mailed direct from this office, 2/- for six issues and 4/- for twelve issues.

To Contributors. The Editor will consider articles and photographs of general interest; payment will be made for those published. Whilst every care will be taken of those submitted, the Editor does not accept responsibility for any loss or damage. A stamped addressed envelope should be sent where the contribution is to be returned if unacceptable.

Binding Cases. Spring-back Binders to take a number of "*M.M.'s*" are supplied, covered with imitation leather and lettered in gold, price 3/- each (post free).

Meccano Writing Pads. Fifty sheets of tinted bank paper, each printed with Meccano boy at head, 1/- (post free) large size, and 6d. (post free) smaller size.

Advertisements

Readers' Sales and Wants. Private advertisements (*i.e.*, not trade) are charged 1d. per word, minimum 1/-. Cash with order. Editorial and Advertising matters should not be dealt with on the same sheet of paper.

Small Advertisements. 1/- per line (average seven words to the line), or 10/- per inch (average 12 lines to the inch). Cash with order.

Display. Quotations for space bookings, and latest circulation figures, will be sent on request.

Press Day, etc. Copy must be received not later than 10th of each month for publication in following issue. Half-tone blocks up to 100 screen.

Proofs of advertisements will be sent when possible for space bookings of not less than half-an-inch.

Voucher Copies. Sent free to advertisers one inch or over. Other advertisers desiring should add 4d. to their remittance and shou voucher copy at same time.

Remittances. Postal Orders and Cheques made payable to Meccano Ltd.

Obtaining the "*M.M.*" Overseas

Readers Overseas and in foreign countries may order the *Meccano Magazine* from regular Meccano dealers, or direct from this office. The "*M.M.*" is sold Overseas at 3d. per copy, or mailed (post free) direct from Liverpool, 2/- for six issues, or 4/- for twelve issues.

IMPORTANT.

Overseas readers are reminded that the prices shown throughout the "*M.M.*" are those relating to the home market. Current Overseas Price Lists of Meccano Products will be mailed free on request to any of the undermentioned agencies. Prices of other goods advertised may be obtained direct from the firms.

CANADA: Meccano Ltd., 45, Colborne Street, Toronto.

AUSTRALIA: Messrs. E. G. Page & Co., 52, Clarence Street, Sydney, N.S.W.

NEW ZEALAND: Messrs. Browning Ifwersen Ltd., P.O. Box 129, Auckland.

SOUTH AFRICA: Mr. A. E. Harris (P.O. Box 1199), Textile House, Von Brandis St., Johannesburg.

£7 a week for life, £10 a week for five years. These huge prizes to be won by readers of "Pearsons" and "Tit-Bits." A "Meccano Guild" member is willing to send solutions of these competitions (which are closing shortly), for a small fee of 2/- and S.A.E. for either list with alternatives of these "catchy" competitions.—Ivan Potter, Hawkhurst, Kent.

CUT THIS OUT. **'Meccano' Pen Coupon, Value 3d.**

Send 5 of these coupons with only 2/9 direct to the **Fleet Pen Co., Fleet Street, E.C.4.** You will receive by return a splendid British 14 ct. Gold Nibbed Fleet Fountain Pen value 10/6 (Fine, Medium, or Broad Nib). If only 1 coupon is sent the price is 3/9. 3d. less for each extra coupon up to 4 (Pocket Clip 4d.). Satisfaction g
Your own name gilt letters, either pen
Lever Self-Filling Model with Safety Cap

RIDE A

FAIRYCYCLE

Regd. Trade Mark

It's Great Fun!

PRICE NOW

49'6

ONLY



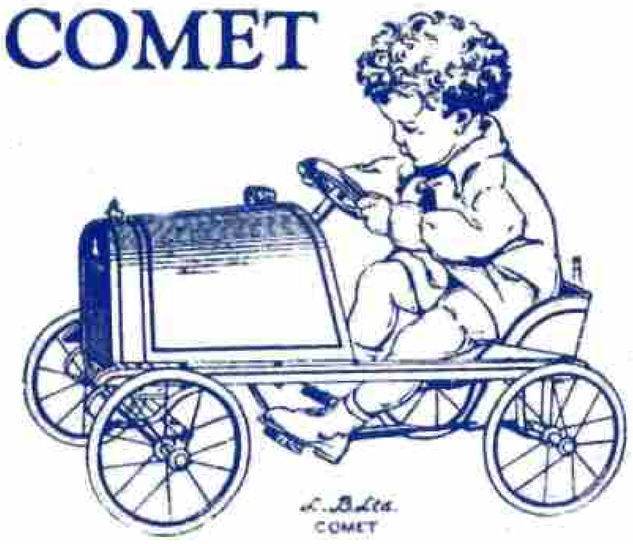
The Manufacturers are giving the public the benefit of reduced costs due to larger production.

If only you had a **FAIRYCYCLE** just think what fun you could have, and what splendid exercise you would get in riding it.

The **FAIRYCYCLE** is a real Cycle—not a make-believe. It is beautifully constructed, runs with remarkable ease, and is safe because the low riding position makes it easy to control. And it is BRITISH.

BE SURE YOU RIDE A FAIRYCYCLE

The COMET



This natty little racing model is the very thing for the youngsters. It is built for sturdy boys and girls, and will stand any amount of rough wear. The double crank movement makes it very speedy.

ℂ Look for the Triangle Trade Mark on all these toys

LINES BROS. LTD. LONDON BROS. ENGLAND

The PEDAL FAIRYKAR

Regd. Trade Mark



Baby will love this Pedal Fairykar. There is nothing to beat it. It is beautifully painted a bright red with nickel-plated handle bar and stem, rubber pedals, etc. A splendid health-giving toy.

OBTAINABLE FROM ALL GOOD TOYSHOPS

Sole Manufacturers:

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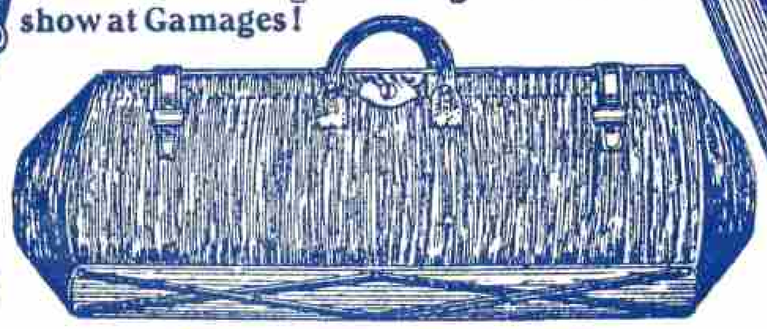
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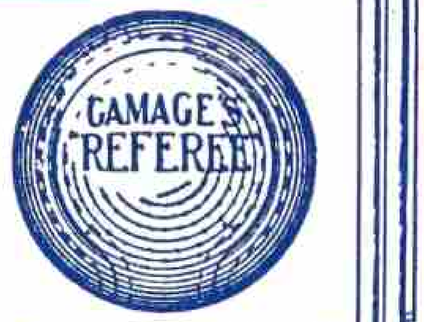
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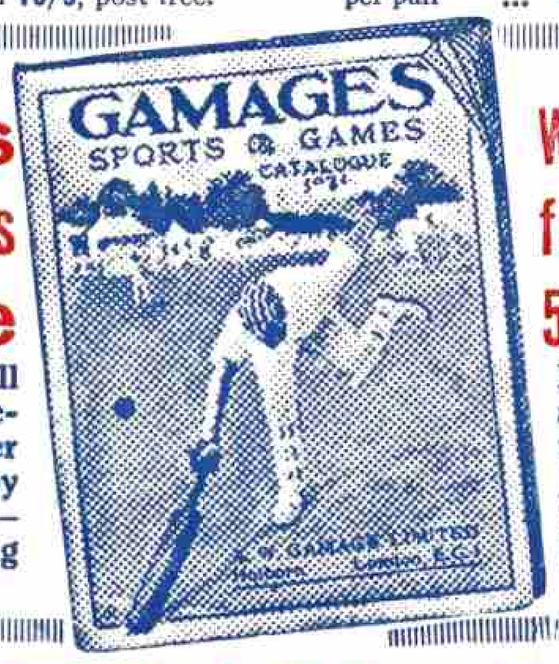


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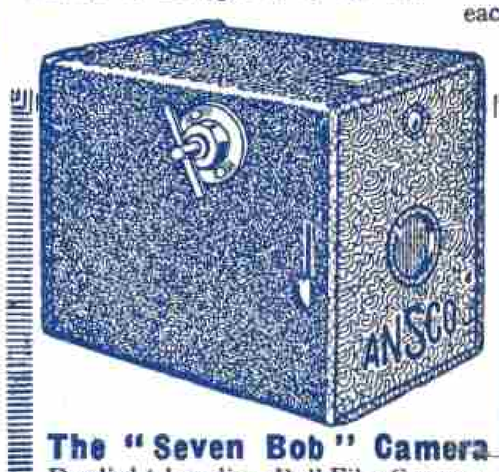


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